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Alberta
ENVIRONMENT

FOREST MANAGEMENT HERBICIDE REFERENCE MANUAL
(Revised May 1999)

This document is divided into five files to increase download speed and functionality.

ACKNOWLEDGEMENT
Appreciation is given to Lakeland College for use of sections in the **Pesticide Applicator Certificate Homestudy Course** and the Alberta Environmental Centre and Alberta Agriculture for sections of the manual **Recognizing Herbicide Action and Injury (Agdex 641-7)**.

Note: This manual is intended as a guideline only. It does not provide the course material for training of Pesticide applicators under the Alberta Environmental Protection and Enhancement Act. For further information on pesticide training call toll free at 1-800-661-3495.

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A. INTRODUCTION

(1) Forest Management Herbicide Reference Manual

Pesticide legislation began on the continent in 1898 when New York state introduced legislation to control the production and sales of arsenic-containing products such as Paris Green. At that time, highly toxic substances such as arsenic and cyanide were commonly incorporated into pest control products. Also, in the absence of regulations, some unscrupulous manufacturers were selling fake remedies of doubtful value, while others used untried or untested chemicals in their formulations.

Canada introduced the *Agricultural Pest Control Act* in 1927. This Act, also aimed at controlling fraudulent pesticides, was replaced by the *Pest Control Products Act* in 1939. Presently, there are over 17 federal statutes and many provincial statutes across Canada dealing with pesticide chemicals. Alberta first introduced legislation covering some aspects of pesticides under the *Public Health Act*. Pesticide legislation under Agriculture was amalgamated with pesticide legislation under the *Public Health Act* to form the *Agricultural Chemicals Act* in the mid 1960s (under Alberta Agriculture). The Agricultural Chemicals Act was moved from the auspices of Alberta Agriculture to Alberta Environmental Protection in 1971 when the department was formed. In 1993, the *Alberta Environmental Protection and Enhancement Act* (AEPEA) was passed into law and replaces eight separate Acts, one being the *Agricultural Chemicals Act*.

The purpose of this manual is to ensure Land and Forest Service personnel and industry:

a. are familiar with current Crown land/forest management herbicide use regulations and policies;
b. take an active role in ensuring herbicide use on Crown land is in accordance with policies and requirements;
c. recognize obvious and important violations of provincial legislation governing

herbicide use on crown land;
d. are comfortable performing basic herbicide inspections; and
e. are aware of incident reporting mechanisms and follow-up.

This manual is divided into different modules which allow for easy reference by the reader and to accommodate future updates. Any inquiries regarding the manual content can be directed to Rob Kesseler or Neil Wandler at Alberta Environmental Protection

B. ROLES AND RESPONSIBILITIES

(1) Environmental Service - Regional Offices:

The role of the Environmental Service regional offices is to provide services to its public within its regional boundaries. Environmental Service inspectors are located in each of the six Alberta Environmental Protection regions. Their responsibilities include:

i. Assisting the public in answering questions and issuing approvals/registrations under AEPEA;
ii. Responding to routine public inquiries;
iii. Responding to public complaints and conducting follow-up enforcement action in the case of violations;
iv. Inspections of regulated activities would be conducted on a spot check basis or on the basis of complaint calls received from forestry personnel or the general public.

(2) Environmental Service - Municipal Program Development Branch - Pesticide Section:

The role of the Pesticide Section includes:

i. Development of standards, policies and programs pertaining to pesticides;
ii. Ensuring Environmental Service regions are familiar with programs/policies pertaining to pesticides and administration is consistent throughout the regions;
iii. Support for the Regional inspectors in their field inspections/investigations of pesticide incidents;
iv. Assisting Environmental Service regions with interpretation of pesticide product labels, legislation, Codes of Practice, and policies;

(3) Natural Resources Service - Fisheries and Wildlife Management - Regional Offices:

Natural Resources Service's role is to ensure conservation of fish and wildlife resources.
Their involvement includes:

i. reviewing forest management herbicide project proposals to ensure the potential impacts on fish and wildlife have been addressed.
ii. reviewing and updating the guidelines for wildlife protection.

(4) Land and Forest Service (LFS):

For forest management:

Land and Forest Service's role is to integrate land use activities and ensure the sustained productivity of forest resources. LFS responsibilities include:

i. policy development regarding where and when herbicides will be used in place of other vegetation management alternatives.
ii. review and approval of appropriate forest management herbicide project proposals.
iii. inspections of representative areas to ensure that herbicide applications

are being conducted in accordance with established policies.

iv. on-site inspections while a herbicide application is in progress, to ensure that the application is being conducted by an approved pesticide service under the direct supervision of certified pesticide applicators and that no obvious violations are occurring (i.e. leaks, spills, improper disposal). Any suspected violations would be documented and reported to the regional Environmental Service inspector for follow-up.

For rights-of-way (ROW) and/or lease sites:

i. report any suspect violations to the regional Environmental Service inspector.

C. LEGISLATION

(1) Federal Legislation - Pesticide Label Requirements

(a) *Pest Control Products Act* (Canada)

The *Pest Control Products Act* is administered by Health Canada, Pest Management Regulatory Agency. The *Pest Control Products Act* and its regulations cover:

i. **Registration** - The registration process clears pesticides for sale by establishing the effectiveness and safety of pesticide products.

ii. **Labelling** - Labels reflect information collected during the registration process and inform users regarding the proper use and handling of each pesticide product.

iii. **Classification** - Pesticides are placed in one of three federal use categories: Restricted; Commercial, including (Agricultural, Forestry, or Industrial), or Domestic. Domestic class pesticides are the only products available to householders for personal use in or around their homes.

All pesticides used in Canada must be registered under the *Pest Control Products Act* (a registration number will appear on each pesticide label). The only pesticide products that will not be assigned a Pest Control Products registration number are granular fertilizers /herbicide combinations which are registered under the *Fertilizer Act*.

Pesticides used in forestry fall in the following product categories defined by Health Canada:

i. **Forest Management - Restricted**

These products can be used for treatment of more than 500 hectares of a wooded area or of a site to be planted in a forest and may include aerial application. All products with a designation for "forest" or "forest management" uses are classified as Restricted. The label of these products bear the statement: "This product is to be used only in the manner authorized; consult local pesticide regulatory authorities about use permits which may be required" No use permits are required in Alberta, however, the applicator must have a Pesticide Service Registration. This applies to all crown, leased and private lands.

ii. **Woodlands Management - Restricted**

These products can be used for the treatment of no more than 500 hectares of a wooded area or of a site to be planted to forest. A site is defined as a continuous monoculture without a break in cultural practices or management stage. A continuous site of 1000 hectares, therefore, can

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https://archive.org/details/forestmanagement00albe

not be divided into several blocks of 500 hectares to qualify as a woodlands management area. Products with directions for Woodland Management can be applied by air only if the label specifically indicated aerial application as a Restricted use. The restriction instructs the user to consult local pesticide regulatory authorities about use permits that may be required.

iii. **Woodlands Management - Commercial**

Commercial pesticide products for woodland management can be used for treatment of no more than 500 ha of a wooded area, as follows:

i. to woodlands only by ground equipment,
ii. in tree nurseries or seed orchards by ground or air,
iii. in treed areas such as municipal parks by ground treatment only

Any information concerning pesticide registration is available from the Pest Management Regulatory Agency at 1-800-267-6315.

The requirements for pesticide registration in Canada are rigorous. Before a pesticide may be registered, research must be conducted and data must be collected to establish a products efficacy and safety. The information listed below is required for pesticide registration.

Registration Requirements for Pesticides

The requirements for pesticide registration in Canada are rigorous. Data are required to support the safety, merit and value of products submitted for registration. Data requirements may vary depending on the nature of the product and the type of registration being applied for. The federal Pest Management Regulatory Agency has produced a **Registration Handbook.** The handbook provides information on the registration process in Canada and general guidance for making registration submissions. Details on specific registration procedures and data requirements are written in various guideline documents and **Regulatory Directives**. Generally, information must be sumitted on:

- **Product Chemistry**
- **Toxicology**
- **Metabolism/Toxicokinetics Studies**
- **Food/Feed and Tobacco Residues** (if the product is to be used on a food/feed or tobacco crop)
- **Environmental Chemistry and Fate**
- **Environmental Toxicology**
- **Efficacy**

For further information please refer to the Pest Management Regulatory Agency's Registration Handbook and Regulatory Directives documents which can be downloaded from their website located at: http://www.hc-sc.gc.ca/pmra-arla

Most people focus on chemical pesticides when considering health or environmental risks; however, other types of pesticides also present concerns. Biorational pesticides are becoming more common and, while toxicological data may be less important, ecological data can be critical. Electrical devices (used to attract and/or control various pests) also require testing and approval prior to use. Requirements for these pest control products are listed below.

Biorational Pesticides

The following categories of Biorational pesticides are regulated under the *Pest*

Control Products Act.

i. microbial pesticides (bacteria, fungi, viruses, and protozoa);
ii. biochemical pesticides such as pheromones, enzymes, hormones, insect growth regulators, plant growth regulators; and genetically engineered and/or modified organisms.

The *PCP Act* does not presently regulate live organisms such as insects, nematodes, mites, or snails which may be used as biological control agents. These products are regulated under the *Plant Health Act* administered by the Plant Health Division of Agriculture Canada. Crops that are genetically altered to incorporate a gene which provides tolerence to a herbicide are regulated under the federal Seeds Act.

Registration Requirements for Biorational Pesticides

- selectivity for the specific pest organism;
- absence of adverse effects on humans;
- absence of adverse effects on domestic animals, fish, wildlife, non-target insects, or desirable plants;
- limitations of influence (never completely eliminate a target plant or animal species);
- absence of detrimental effects on water quality;
- lack of accumulation in non-target organisms;
- ease of production and dissemination;
- effectiveness under the environmental conditions of the intended use locations;
- simplicity of assay for its presence in small amounts.

Regulation Requirements for Electrical Devices

- detailed specifications of the trapping and attracting units
- detailed specifications of auxiliary components such as guards, shields, reflectors, and transformers
- effective life of the attracting component
- mode of action
- effective range
- data to support safety and effectiveness

(2) Provincial Legislation

(a) The Alberta Environmental Protection and Enhancement Act (AEPEA)

The Act was passed into law in 1993 and replaced eight separate Acts. Provisions for regulations of pesticides are set out in Part 8 of the *AEPEA*, with the enforcement provisions of the entire Act contained in Parts 10 and 11.

Part 8 of the *AEPEA* sets out the framework for the regulation of sales, use, application, handling, storage, transportation and disposal of all pesticides. Two associated regulations deal with pesticides:

- **Pesticide (Ministerial) Regulation (AR 43/97)**, and
- **Pesticide Sales, Handling, Use and Application Regulation (AR 24/97)**

In 1997, both these regulations replaced the former regulations (of the same name)

in order to streamline administration and to ensure that the requirements are in keeping with current pesticide technology.

NOTE: Copies of *AEPEA*, the *Pesticide (Ministerial) Regulation (AR 43/97)* and the *Pesticide Sales, Handling, Use and Application Regulation (AR 24/97)* are available from Queen's Printer bookstore in Edmonton (403/427-4952) or in Calgary (403/297-6251).

The pesticide regulations are administered by the regional offices of Environmental Service, Alberta Environmental Protection. Regional Environmental Service offices are located in:

Prairie: Lethbridge Ph. (403) 381-5511
Bow: Calgary Ph. (403) 297-8271
Parkland: Red Deer Ph. (403) 340-5310
Northeast Boreal: Edmonton Ph. (780) 427-7617
Northeast Slopes: Edson Ph. (780) 723-8395
Northwest Boreal: Grande Prairie Ph. (780) 538-5460

(b) Environmental Code of Practice for Pesticides (hereafter referred to as the *Code*)
The *Environmental Code of Practice for Pesticides* is incorporated by the *Pesticide (Ministerial) Regulation* and the Pesticide Sales, Handling, Use and Application Regulation under the authority of Section 36 of *AEPEA*. Pesticide applicators and Pesticide services affected by this code must meet all the requirements to ensure that their activities are in compliance with Alberta's environmental laws. The following conditions can be found in the *Code* and pertain to forest management pesticide use. Other sections of the *Code*, applicable to pesticide applications in the Green Area, are also outlined throughout this manual.

NOTE: Copies of the *Environmental Code of Practice for Pesticides* are available from Queen's Printer bookstore in Edmonton (403/427-4952) or in Calgary (403/297-6251).

Forest Management Pesticide Use

The following is taken verbatim from the *Code*:

> *11 (1) For the purposes of this section, "owner" means a tenant or other person who is in lawful possession or occupation of the land including, but not limited to, the holder of a Forest Management Agreement, a Disposition Holder, or a quota holder.*
>
> *(2) The application of pesticides in a forest is restricted to the location, target area, pesticide, pesticide application method, pesticide application rate and application time authorized in writing by a designated employee of Alberta Environmental Protection, Land and Forest Service, following submission by a proponent of a project proposal for the application of pesticides in a forest, in accordance with the most recent edition of Guidelines For the Use of Herbicides For Silviculture in Alberta published*

by Alberta Environmental Protection.

(3) *The applicator responsible for supervising pesticide mixing must be in possession of the written authorization and the corresponding project proposal referred to in section 11(2) while herbicide treatments are being conducted.*

(4) *The applicator shall:*

1. *identify all open bodies of water within the application site on maps or aerial photographs,*
2. *keep maps and aerial photographs with application records, and*
3. *mark or flag all open bodies of water that will not be clearly visible to the applicator during the application.*

(5) *The following individuals or agencies must be notified a minimum of 72 hours prior to each pesticide application by the owner or the owner's agent:*

1. *all private property owners, and resident holders of a public land disposition immediately adjacent to the application site;*
2. *all holders of a public land disposition on the application site; and*
3. *any person who was offered notification through a public involvement program.*

(6) *The owner of the application site or the owner's agent shall:*

1. *post signs immediately prior to a pesticide application advising that a pesticide application is in progress;*
2. *ensure that the signs remain in place for a minimum of 48 hours following the pesticide application; and*
3. *ensure that the signs are removed after 48 hours has passed following the pesticide application.*

(7) *The owner of the application site shall ensure that a mixing and loading site is located:*

1. *on land held by the owner of the herbicide treatment area;*
2. *on land held by an owner other than the owner of the herbicide treatment area where the owner has given permission to conduct mixing or loading operations; or*
3. *on land where a written authorization to conduct mixing or loading operations has been provided by a designated employee of Alberta Environmental Protection, Land and Forest Service.*

(8) *Pesticide mixing and loading must be conducted or directly supervised by a certified applicator who holds a Forestry class of applicator certificate.*

Pesticide Service Registration Requirements

Under the pesticide regulations, all Pesticide Services operating within Alberta must be **registered** in accordance with the *AEPEA*.

A Pesticide Service is a business, government agency or an organization that:

- provides, or offers to provide, a pesticide application service for hire or reward;
- is applying pesticides on a right-of-way;
- is applying pesticides on a park, boulevard, campground or picnic area located on public land. Public land meaning federal, provincial or municipal governments and irrigation districts; and

- is applying pesticides for forest management.

Pesticide Service Registration is intended to:

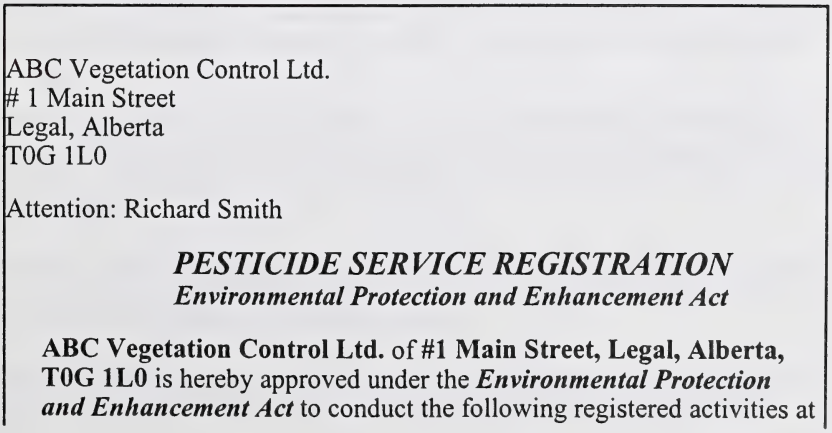
- ensure the public is obtaining the pesticide application services of only businesses that meet provincial regulatory requirements (including certified applicators);
- an up-to-date database of Pesticide Services is available to facilitate receiving important regulatory updates when necessary;
- ensure that Pesticide Services are inspected on a regular basis and are in compliance with provincial pesticide regulations;
- facilitate rapid complaint response;
- facilitate enforcement action where necessary.

A pesticide service must employ at least one certified pesticide applicator. The types of services provided will be limited to those for which the applicator(s) is/are certified.

- Non-certified employees must be adequately supervised when handling or applying pesticides;
- Pesticide application equipment must be in good working order;
- Records must be kept of each pesticide application;
- Pesticides must be stored in accordance with provincial regulations;
- Mixing and loading sites must be managed to prevent environmental contamination;
- Insurance coverage must be maintained (General liability insurance for all Pesticide Services of $1,000,000 plus $25,000 drift coverage for Aerial and Agriculture classes).

A Pesticide Service can become registered by obtaining an application form from any regional office of Alberta Environmental Protection listed here or download them from Alberta Environmental Protection's Internet homepage at http://www.gov.ab.ca/env/.

Once the completed forms have been received, an inspector will telephone to arrange a convenient date and time for an on-site inspection. When all Pesticide Service requirements have been verified through the inspection, the Pesticide Service will be registered. A business must be registered as a Service ***before*** commencing to provide an application service. An example of a Pesticide Service registration can be found below.



ABC Vegetation Control Ltd.
1 Main Street
Legal, Alberta
T0G 1L0

Attention: Richard Smith

PESTICIDE SERVICE REGISTRATION

Environmental Protection and Enhancement Act

ABC Vegetation Control Ltd. of **#1 Main Street, Legal, Alberta, T0G 1L0** is hereby approved under the ***Environmental Protection and Enhancement Act*** to conduct the following registered activities at

Plan 7621498, Block 5, Lot 7:

- to offer a pesticide service (**AGRICULTURE, FORESTRY, and INDUSTRIAL**)

This registration is only transferable in accordance with provisions of the legislation and valid from:

February 1, 1997 to **October 1, 2001**.

Date of Issue: February 1, 1997

Regional Director

Applicator Certification Requirements

Any person involved in the application of a pesticide for hire or reward requires a pesticide applicator certificate. Hire or reward refers to compensation through exchange of money, commodities or services, but does not include exchange of agricultural production services (ie. disking, swathing, combining, etc.).

Classes of Applicator Certification

Agriculture
Industrial
Aerial
Structural
Biting fly control
Seed Protectant
Interior Plantscape
Stump Treatment
Fumigation
Greenhouse
Aquatic
Forestry
Landscape

The following is a brief description of the classes of Pesticide applicator certificates that are required for applications in the Green Area.

Industrial - use of pesticides to control vegetation on industrial and non-cropland including but not limited to roadsides, powerlines, pipelines, right-of ways, railways, wellsites, and equipment yards. This category includes herbicide applications to parking lots and road beds during construction. In addition, this category includes the control of designated noxious and restricted weeds.

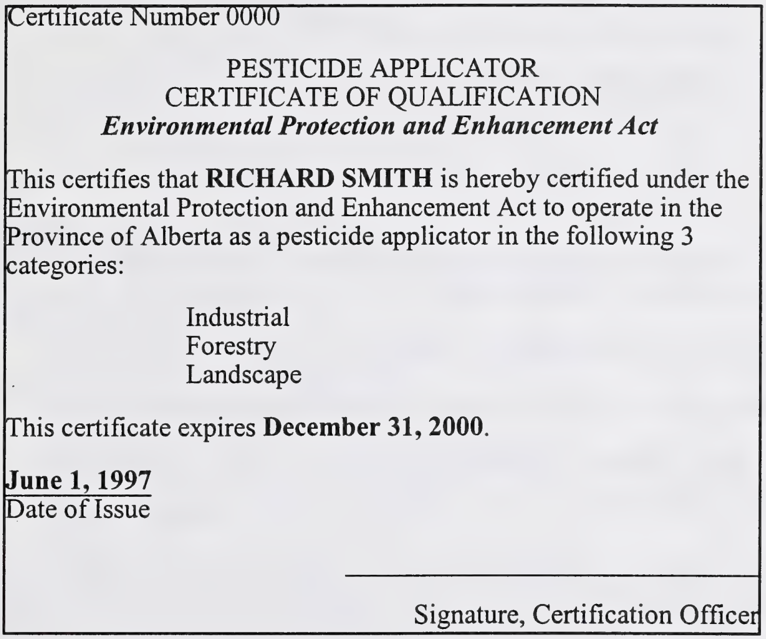
Forestry - use of pesticides in forest management operations including site preparation, brushing, conifer release, thinning, insect and disease control. This category includes pesticide use in forest seed orchards, outdoor nurseries and plantations.

Aerial - Aerial application of pesticides by air to forests, right-of-way, and agriculture land including orchards. Includes the use of insecticides for control of mosquitoes or biting fly larvae or adults.

NOTE: an applicant for an aerial applicator certificate must establish to the director's satisfaction that the applicant holds the appropriate flight crew

licence issued under the *Aeronautics Act* (Canada)

Special - stump treatment only



Certificate Number 0000

PESTICIDE APPLICATOR
CERTIFICATE OF QUALIFICATION
Environmental Protection and Enhancement Act

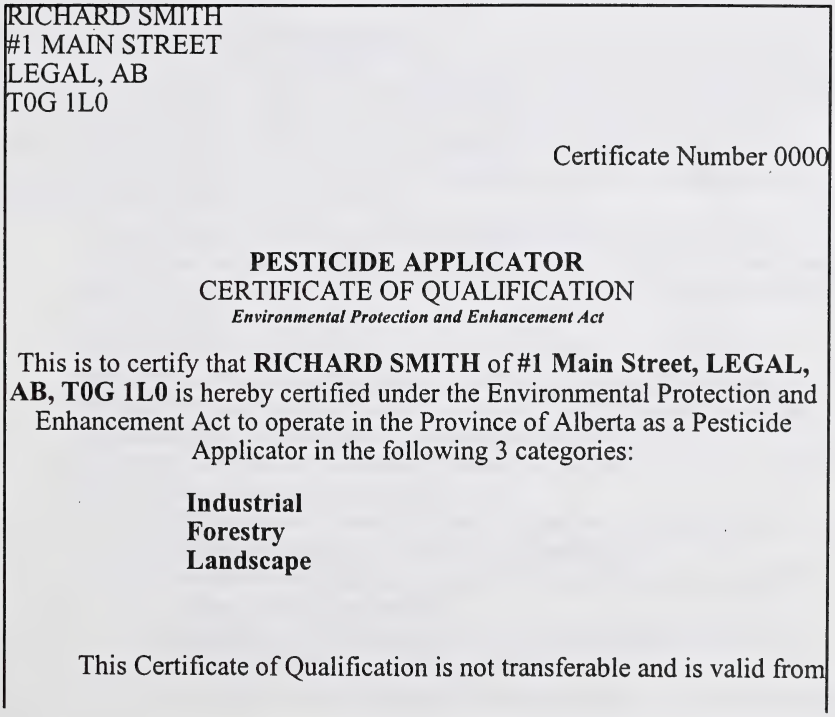
This certifies that **RICHARD SMITH** is hereby certified under the Environmental Protection and Enhancement Act to operate in the Province of Alberta as a pesticide applicator in the following 3 categories:

Industrial
Forestry
Landscape

This certificate expires **December 31, 2000**.

June 1, 1997
Date of Issue

Signature, Certification Officer



RICHARD SMITH
#1 MAIN STREET
LEGAL, AB
T0G 1L0

Certificate Number 0000

PESTICIDE APPLICATOR
CERTIFICATE OF QUALIFICATION
Environmental Protection and Enhancement Act

This is to certify that **RICHARD SMITH** of **#1 Main Street, LEGAL, AB, T0G 1L0** is hereby certified under the Environmental Protection and Enhancement Act to operate in the Province of Alberta as a Pesticide Applicator in the following 3 categories:

Industrial
Forestry
Landscape

This Certificate of Qualification is not transferable and is valid from

June 1, 1997 to **December 31, 2001**.

Date of Issue: June 1, 1997

Signed ______________________

Signature, Certification Officer

Restricted Pesticide Applicator Certificate

Restricted Pesticide Applicator Certificates are issued to persons 18 years or older who lack the training necessary for a full Pesticide Applicator Certificate where one of the following conditions exist:

- the Service Registration holder suddenly and unexpectedly loses the services of the certified applicator,
- an emergency pest management situation arises where more certified applicators are required, or
- applications provided by the Service Registration involve routine, repetitive, low risk applications where supervision is available from a certified applicator.

Restricted Pesticide Applicator Certificates are issued for a two year period and are not renewable. A restricted certificate holder is expected to complete the missing full certificate requirements within the two year period.

Applicator Supervision Requirements

Uncertified assistants may be employed by the holder of a Pesticide Applicator Certificate. The certified applicator must include all pesticide applications carried out by his/her uncertified assistants on his/her pesticide applicator records. Furthermore, the certified applicator is personally responsible for any misapplications carried out by an uncertified assistant. Applicator supervision requirements can be found in the *Code*:

- An **applicator, other than an aerial applicator**, is permitted to supervise an unlimited number of assistants if the applicator can directly observe the assistants pesticide activities and is immediately available for emergencies;
- An **applicator, other than an aerial applicator**, can supervise 6 assistants provided the applicator is present at the application site once per day provided the same pesticide application, application equipment, and calibration are being used throughout the day.
- If the applicator is not physically present, the applicator must check the following at each application site:
    - the amount of pesticide used corresponds with the area treated;
    - the application equipment is not leaking;
    - protective equipment is present, in good condition, and is being worn by assistants;
    - applicator records are maintained in accordance with the *Pesticide (Ministerial) Regulations;*
    - application and handling practices comply with provincial law.

- An **applicator must be physically present**, whether or not any assistants are being supervised; throughout the following pesticide applications:
    - mixing and loading, use, application, or cleanup of any Schedule 1 pesticide;
    - **any pesticide application conducted for forest management;**
    - spraying trees with any insecticide other than *bacillus thuringiensis* or soap;
    - mosquito adulticide applications;
    - application of any nonselective herbicide containing any of the following active ingredients:
        - atrazine
        - bromacil
        - diuron
        - hexazinone
        - imazapyr
        - simazine
        - sodium chlorate
        - sodium metaborate octahydrate
        - sodium chlorate
        - sodium metaborate tetrahydrate
        - tebuthiuron
    - application along a right-of-way with any pesticide product containing the active ingredient picloram.
- Where the pesticide label requirements specify that the pesticide shall only be applied by an authorized applicator, certified applicator, pest control operator, or other approved applicator, or any similar restriction.

Pesticide Applicator Records Requirements

All applicators or assistant must keep records of their pesticide applications for a five year period. These records must be available upon request of a pesticide inspector. Records **must** include the following information:

- the name of the person for whom the pesticide was applied;
- the location where the pesticide was applied
- the year, month, day and time at which the pesticide was applied;
- the name of the pest and purpose for which the pesticide was applied;
- the approved common name or trade name of the pesticides and the Pest Control Products Act (Canada) registration number;
- the application rate and total quantity of the pesticide applied;
- the method of application;
- if the pesticide was applied outside an enclosed structure, the meterological conditions prevailing at the time of the application, including temperature, humidity, precipitation, and approximate wind speed direction

Requirements for Pesticide Storage

Section 23(1) of the *Pesticide Sales, Handling, Use and Application Regulation 24/97* states:

A person who stores a pesticide listed in Schedule 1 or 2 shall comply with the following requirements:

a. the storage facility is secure from public access;

b. a warning sign is affixed to the exterior door, entrance or gate to the storage facility;
c. floor drains leading directly or indirectly into a wastewater system, storm drainage system, waterworks system, or other potable water source, groundwater or an open body of water are protected form a release of a pesticide.
d. release of pesticide concentrate can be contained within the boundaries of the storage site;
e. the floor base of the storage facility is protected from pesticide absorption;
f. open containers or packages of pesticide are closed or repackaged in a manner that controls the release of odours and vapours;
g. material safety data sheets and emergency telephone numbers are available for all pesticides stored and accessible at the storage facility.
h. persons responsible for the pesticide storage facility are knowledgable of spill clean-up and fire response procedures; and
i. pesticides are protected from rain, wind and other weather hazards.

All Service Registration Holders storing Pesticides must have their storage facility inspected by an inspector from Alberta Environmental Protection.

If only enough of the pesticide is kept at the mixing and loading site to complete the spray operations for that area, then this would not be considered a storage site. In this situation, compliance to the regulations regarding Pesticide Storage is not required although if pesticides are left overnight, site containment and security should be considered.

NOTE: If the pesticides are left at one site and distributed to other mixing and loading sites as required, then the initial mixing and loading site where the pesticide is kept would be considered a storage site.

Spill Cleanup and Emergency Response Information

Part 4 of *AEPEA* empowers the government to prevent and control the release of substances into the environment. It ensures that the unlawful, unauthorized, or accidental release, as well as those exceeding prescribed amounts, are quickly remedied to protect the environment. The Act imposes a requirement on companies to report substance releases so that control and cleanup are prompt and effective.

Those responsible for released substances have a duty to take remedial action. These measures include stopping the release , cleanup and the release, removal or disposal of the substance and restoring the environment to a satisfactory condition.

Emergency response equipment, including spill cleanup and safety equipment, is required at both the storage facility and the mixing and loading site. Emergency response equipment must include:

personal protective equipment including:

- chemical resistant gloves;
- coveralls and a chemical-resistant apron as required for the pesticides being handled;
- chemical resistant boots;
- eye protection;
- suitable cartridge respirators including extra cartridges for reusable

respirators;
- first aid kit; and
- emergency eyewash or emergency shower on site.

emergency response information including:
- Material Safety Data Sheets (MSDS) or pesticide labels for the pesticides being used;
- emergency numbers as required for the pesticides being handled such as:
  - Alberta Environmental Protection's Complainant / Emergency number (1-800-222-6514)
  - the provincial Poison Centre (1-800-332-1414)
  - the local police department and fire department
  - the manufacturer or suppliers of the pesticides

spill cleanup materials including:
- appropriate absorbent materials, such as vermiculite, kitty litter, dry coarse clay, or commercial absorbent;
- appropriate neutralizing materials, such as hydrated lime, bleach, or activated charcoal;
- a broom or shovel; and
- containers with lids for waste material or leaking containers and supplies to label the contents of the waste containers.

For all pesticide mixing and loading sites, the applicator must ensure that a contingency plan for the containment and cleanup of pesticide release is available and understood by personnel working at a pesticide mixing and loading site.

Special Use Approvals

A **Special Use Approval** is an approval from Alberta Environmental Protection to use, store, or apply pesticides in, on or within 30 horizontal metres of an **open body of water**.

The maintenance of a buffer from an **open body of water** is very important. The natural vegetation along water bodies (trees, shrubs, cattails, reeds, etc.) provides important wildlife habitat. This vegetation helps maintain consistent water temperatures (critical for fish), provide habitat for fish-food organisms, and acts as a filter for nutrients that enter surface water from cultivated land. Vegetation also helps prevent soil erosion by stabilizing shoreline soils.

Aquatic vegetation provides food and shelter for aquatic organisms. Aquatic plants also maintain water quality by stabilizing bottom sediments and utilizing nutrients that would otherwise cause algal blooms.

An **open body of water** is defined in the regulations as:

> the bed and shore of an irrigation canal, drainage canal, reservoir, river, stream, creek, lake, marsh or other body of water, but does not include the following:
> i. waterworks systems;
> ii. reservoirs, lakes, marshes or other bodies of water that are completely surrounded by private land, that have an area of less than 4 hectares and have no outflow of water beyond the private land;
> iii. resevoirs, lakes, marshes or other bodies of water that are located on public land, that have an area of less than 0.4 hectares, and have no outflow of water;

iv. irrigation and drainage canals that are completely surrounded by private land and have no outflow beyond the private land;
v. roadside ditches;
vi. wastewater systems;
vii. storm drainage systems;
viii. dry streams having a bed and shore averaging 0.5 metres or less in width within the boundaries of the treatment area;

A **bed and shore** means land that is or has been covered by water to the extent that:

- no vegetation grows on the land, or
- the vegetation that grows on the land is aquatic vegetation that must be partially submerged in water for part of its lifecycle to survive.

A Special Use approval is **not** required in the following situations:

- the area to be treated has been cultivated for crop production, pasture, or residential landscape purposes, or
- the person conducting the application is a certified applicator who conforms to the *Environmental Code of Practice for Pesticides* (published by the Pesticide Management Branch).

The *Code* limits the application of pesticides within 30 metres of water. The following is taken verbatim from the *Code*:

> ***16(1)*** *In this section, **"observable impact"** means visible effects, such as plant injury, resulting from pesticide application.*
>
> ***(2)*** *Applicators are restricted to the following herbicides within 30 metres of an open body of water unless otherwise authorized by an approval under the AEPEA:*
>
> *a.* ***2,4-D****
> *b.* ***amitrole***
> *c.* ***chlorsulfuron***
> *d.* ***dicamba in combination with either 2,4-D, mecoprop or both,***
> *e.* ***dichloroprop***
> *f.* ***glyphosate****
> *g.* ***MCPA***
> *h.* ***metsulfuron methyl***
> *i.* ***paraquat***
> *j.* ***triclopyr****
> *k.* ***imazapyr for use on railway ballast areas only***
>
> **registered for use in forest management*
>
> ***(3)*** *Any person applying any of the herbicides listed in section 16(2) shall do so in a manner that does not create an observable impact on vegetation within 5 horizontal metres of an open body of water.*
>
> ***(4)*** *Section 16(3) does not apply where imazapyr is applied on railway ballast areas in a manner that does not create an observable impact on vegetation within 15 metres of the open body of water.*
>
> ***(5)*** *An applicator shall selectively apply herbicides within the zone between 5 and 30 horizontal metres from an open body of water by:*
>
> *a. using a backpack sprayer, a pump sprayer, a hand-gun sprayer or an application method that treats individual woody plants, and*

   b. *treating no more than 30% of the vegetation, based on distribution over one hectare, within any one hectare zone.*

(6) An applicator shall restrict herbicide applications within the zone between 5 and 30 horizontal metres of an open body of water

   a. *to the control of herbaceous plants classified as "restricted" or "noxious" weeds under the Weed Control Act, and*
   b. *for the control of woody plants to areas where the woody plants interfere with*
      i. *forest regeneration or*
      ii. *the safe operation, functioning, or maintenance of man-made structures such as dams, canals, drainage ditches, roads, industrial facilities, or utility or pipeline rights-of-way.*

(7) Sections 16(5) and 16(6) do not apply where:

   a. *glyphosate is applied as a band treatment bordering maintained trails,*
   b. *glyphosate is applied on forest regeneration areas,*
   c. *glyphosate is used to manage vegetation-free industrial areas such as flare stacks, or*
   d. *imazapyr is applied on railway ballast*

(8) Applicators shall not apply herbicides where there are visible signs of soil erosion.

(9) Applicators are restricted to the following insecticides within 30 horizontal metres of an open body of water unless otherwise authorized by an approval under the AEPEA:

   a. *Bacillus thuringiensis,*
   b. *insecticidal soap, or*
   c. *insecticides applied by direct injection, banding, or basal spray to trees.*

(10) No applicator shall allow insecticide to drift into or onto an open body of water.

(11) Applicators shall restrict the application of rodenticides to products and application methods that will ensure the protection of water and non-target organisms.

(12) Applicators shall not conduct aerial applications of pesticides to land while flying directly over water.

NOTE: The 5 metre no impact zone may be extended on a site specific basis. An Alberta Environmental Protection official can identify an open body of water to require a greater buffer, in the authorizations to apply pesticides issued to the forest management companies, if the removal of more than the 5 metres of vegetation may excessively impact wildlife, fish and other aquatic life at that open body of water.

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forests

Alberta
ENVIRONMENT

(c) *Weed Control Act*

The *Weed Control Act* was designed to prevent the introduction and unchecked spread of plants that are considered serious weed problems due to their ability to spread and thrive at the expense of agricultural crops or native vegetation. Problem "weeds" have been designated under three categories depending on the severity of the problems they present. These categories are "restricted weeds" (these weeds must be destroyed), "noxious weeds"(these weeds must be controlled and "nuisance weeds" (these weeds may be designated either restricted or noxious by local authorities within the province). Under the *Weed Control Act*, a person can be forced to destroy or control weeds (restricted or noxious) even if the weeds are on private property. Where land is leased, the lease holder or the landowner may be held responsible for weed control depending on the lease agreement. All sightings of restricted or noxious weeds should be reported to the agricultural fieldman (rural areas) or bylaw enforcement officer (urban areas). Designated weed inspectors patrol the province and have the authority to issue "weed notices". Designated weed inspectors do not require a pesticide applicator certificate to apply schedule 2 pesticide while controlling noxious or restricted weed species while under the *Weed Control Act*.

The following is a current list of weeds named under the *Weed Control Act*. Applicators should be careful to check bylaws within their working area to see whether or not certain nuisance weeds have been classified noxious or restricted.

Restricted Weeds

- Red bartsia - Odontites serotina L.
- Diffuse Knapweed - Centaurea diffusa L.
- Spotted Knapweed - Centaurea maculosa L.
- Nodding thistle - Carduus nutans L.
- Eurasian Water Milfoil - Myriophyllum spicatum L.
- Dodder- Cuscuta spp.
- Yellow star thistle - Centaurea solstitialis L.

Noxious Weeds

- Russian Knapweed - Centaurea repens L.
- Field bindweed - Convolvulus arvensis L.
- White cockle - Lychnis alba
- Bladder campion - Silene cucubalus
- Hoary cress - Cardaria spp.
- Knawel - Sceranthus annuus
- Perennial sow thistle - Sonchus arvensis L.
- Cypress spurge - Euphorbia cyparissias L.
- Leafy spurge - Euphorbia esula L.
- Stork's bill - Erodium cicutarium L.
- Canada thistle - Circium arvense L.
- Toadflax - Linaria vulgaris
- Persian Darnel - Lolium persicum

- Scentless Chamomile - Matricaria martima L.
- Common tansy - Tanacetum vulgare L.
- Blue weed - Echium vulgare L.
- Cleavers - Galium aparine L. and Galium spurium
- Spreading Dogbane - Apocyynum and rosaemifolium L.
- Filed Scabiuos - Knautia arvensis (L.) Duby
- Hound's Tongue - Cynoglossum officiale L.
- Oxeye Daisy - Chrysanthemum leacanthemum
- L.Tall Buttercup - Ranunculus acris L.
- Purple Loosestrife - Lythrum salicaria

Nuisance Weeds

- Dalmation toadflax - Linaria dalmatica L.
- Wild radish - Raphanus raphanistum L.
- Creeping bellflower - Campanula rapunculoides L.
- Hedge bindweed - Convolvulus sepium L.
- Bluebur - Lappula echinata
- Downy brome - Bromus tectorum
- Tartary buckwheat - Fagopyrum tartaricum
- Wild buckwheat - Polygonum convolvulus
- Biennial campion - Silene noctiflora L.
- Night-flowering catchfly - Silene noctiflora L.
- Common chickweed - Stellaria media L.
- Field chickweed - Cerastium arvensis L.
- Mouse eared chickweed - Cerastium vulgatum L.
- Rough cinqefoil - Potentilla norvegica L.
- Cow cockle - Saponaria vaccaria L.
- Flixweed - Descurainia sophia L.
- Green foxtail - Setaria viridis L.
- Quack grass - Agropyron repens L.
- Narrow-leaved hawk's-beard - Crepis tectorum L.
- Hemp nettle - Galeopsis tetrahit L.
- Henbit - Lamium amplexicaule L.
- Lady's-thumb - Polygonum persicaria
- Round-leaved mallow - Malva rotundifolia L.
- Ball mustard - Neslia paniculata
- Dog mustard - Erucastrum gallicum
- Green tansy mustard - Descurainia pinnata
- Wild mustard - Sinapsis arvensis L.
- Wormseed mustard - Sinapsis arvensis L.
- Wild oats - Avena fatua L.
- Redroot pigweed - Amaranthus retroflexus L.
- Shepherd's-purse - Capsella bursa-pastoris L.
- Annual sow thistle - Sonchus oleraceus L.
- Corn spurry - Spergula arvensis L.
- Stinkweed - Thlaspi arvense L.
- Russian thistle - Salsola pestifer
- Dandelion - Taraxacum officinale

D. HERBICIDES

(1) Classification

Mode of Action

NOTE: Mode of Action may refer to the descriptive action of a herbicide, the physiological action of a herbicide, as listed here, or it may refer to the physiological or biochemical action of a

herbicide. In this manual, the physiological or biochemical action of a pesticide is termed its "biological activity" rather than its mode-of-action.

Selectivity

Selective herbicides are used to control broadleaf or grass species but they rarely have activity on both plant groups.

Selective herbicides take advantage of physical differences, biochemical differences, or differences in plant development stages among or within plant species. These herbicides must be used at the correct rate and at the correct development stage to ensure selectivity.

Physical Factors Affecting Herbicide Effectiveness

Physical factors affecting herbicide effectiveness are those factors that influence contact between herbicides and plant surfaces as well as the retention of these chemicals on surfaces.

- Leaf surfaces with heavy, waxy coatings or with guard hairs are more difficult to wet (the herbicide solution beads up and is retained on the leaf surface without being absorbed). Herbicide penetration could therefore be altered by the addition of a wetting agent (to reduce the surface tension of droplets of herbicide solution spread of the solution over a large area and better able to penetrate the cuticle).
- Leaves of grasses are narrow and stand upright, so spray droplets may run off without being absorbed or not enough of the herbicide solution is retained on the leaf to have an effect. Retention and penetration could be altered by the addition of a sticking agent.
- Broadleaf plants have wide horizontal leaves that provide a large target area for herbicide compared to grasses that have narrow leaves.
- Water quality may affect herbicide performance (ie. mixing some herbicides such as Vision® with dirty water will bind the herbicide in the tank before it is sprayed).

(2) Environmental Considerations with Herbicide Use

The acute toxicity of most herbicides to fish and wildlife is generally low. Most critical concerns are the potential alteration of wildlife habitat. There may be effect regardless of the method of vegetation removal on a site, be it harvesting, fire, mechanical vegetation control or herbicides. The most important consideration is to know and monitor how long a period the impact will take place and to adjust treatment programs to lessen the impacts. Proper vegetation management planning (ie. treatment type, herbicide type, timing, product rates) will mitigate negative impacts.

Some adverse effects from herbicide applications are listed below:

- If adequate buffers are not maintained, loss of vegetation canopy over streams, which provide cover for fish, protects the stream against temperature extremes and erosion, and contains insects and plants that are important aspects of the stream ecosystem and fish food.
- Loss of cover for many forms of wildlife including birds, ungulates, and carnivores.
- Short term loss of diversity of plant species which encourages pest species and is ecologically unstable.
- Short term loss of plant species that wildlife would utilize as a food source.
- Increased predation of certain animals utilizing treated area.

(3) Herbicides Registered for Forestry Use

Brief descriptions of the herbicides registered for forest management use in Canada are provided below. Complete information for a particular product can be obtained from the product label. Additional information can also be obtained from various websites. Two examples are:

EXTOXNET - The Extension Toxicology Network - this is a cooperative effort of the University of California - Davis, Oregon State University, Michigan State University, Cornell University and the University of Idaho. They have on their site "Pesticide Information Profiles" or "PIPS" which give a good general description (use patterns, human and environmental information, etc.) of quite a number of different pesticides. Their website is: http://ace.ace.orst.edu/info/extoxnet/pips/pips.html

Weed Science Society of America (WSSA) - this ia a society of professional and technical people from industry and academia that conduct research on weed science and herbicides. Their site also has links to the major herbicide manufacturers. Their site is located at http://ext.agn.uiuc.edu/wssa/

2,4-D

Active Ingredient - 2,4-D

Common Trade Name - Forestamine Esteron 600, No Weed 600, Esteron LV600, 2,4-D Amine 500.

General Use - 2,4-D is a selective, post emergent systemic herbicide. It is use to control aquatic vegetation, woody plants, and broadleaf weeds in crop, non-cropland, forest and woodland areas. 2,4-D can be used in combination with other herbicides.

Mode of Action - 2,4-D is primarily absorbed by foliage, but there is some root uptake. Once it has been absorbed, 2,4-D translocates to the meristematic regions of shoots and roots. The rate of translocation is dependent upon the growth status of the plant. 2,4-D mimics natural plant growth regulators known as auxins and causes an accelerated growth response which, in many cases, causes the plant to die.

Weedone

Active Ingredient - 2,4-D + dichlorprop

Common Trade Name - Weedone CB, Silvaprop 700.

General Use - Selective systemic use to control brush and/or weeds in non-crop forestry and woodland areas.

Mode of Action - Absorbed by leaves and/or bark and translocated through plant.

Glyphosate

Active Ingredient - Glyphosate

Common Trade Name - Vision, Ezject

General Use - Glyphosate is a non-selective, post emergence, systemic herbicide that is used on forest and woodlands to control a wide range of annual and perennial grasses, broadleaf weeds and woody plants.

Mode of Action - Glyphosate is a systemic herbicide which utilizes the plants nutrient transport system to translocate from the leaves to the roots. Glyphosate kills the plant by inhibiting amino acid biosynthesis.

Hexazinone

Active Ingredient - Hexazinone

Common Trade Name - Velpar, Velpar L, Pronone 5G, Pronone 10G

General Use - Hexazinone is a non-selective herbicide. It is used for total vegetation control and bare ground maintenance on non-croplands, for woodland planting site preparation and conifer

release.

Mode of Action - Hexazinone can be absorbed by the foliage, however, root uptake is the principle means by which it enters the plant. Once absorbed by the roots, hexazinone translocates upward in the foliage, where it inhibits photosynthesis..

Triclopyr

Active Ingredient - Triclopyr

Common Trade Name - Release

General Use - Triclopyr is a selective, post emergent systemic herbicide. It is used to control woody plants and broadleaf weeds in forest and woodland management areas.

Mode of Action - Triclopyr is adsorbed by foliage and roots. Once it has been absorbed, triclopyr translocates through the root and shoot systems. The rate of translocation is dependent upon the growth status of the plant. Triclopyr is an auxin type herbicide and causes an accelerated growth response in the plant that, in many cases, causes them to die.

(4) Methods of Herbicide Application

Foliage spraying

Spray material is applied to leaf surfaces as a "shower" from a spray gun. Foliar applications can be made using ground or aerial application equipment. The best time to carry out foliage spraying is in early summer when leaves are fully opened and translocation is rapid. However, if conifer damage is undesirable, the application must be delayed until the conifers have set their buds.

Stem/foliage treatment

In this application procedure, both stems and foliage are sprayed to the saturation point. This application method is typically used where vegetation is dense. The best time to carry out stem/foliage applications is early summer, where translocation is rapid. However, if conifer damage is undesirable, the application must be delayed until the conifers have set their buds.

Dormant cane spraying (dormant spraying)

This application procedure is similar to a stem/foliage treatment except that it is done when the vegetation is dormant in the fall or early spring. Herbicides are usually applied in an oil base to aid penetration. This procedure may not give a as good results as early summer (full leaf) treatments.

Basal spraying

This type of application is generally used where a high degree of selectivity is desired. Herbicides are usually mixed in an oil carrier to encourage penetration and applied to the lower 50 cm of the stems. other basal application methods may be described on the pesticide label. The cost of this type of application is proportional to the number of stems treated, and it is not usually practical in dense vegetation. Basal spraying is most effective in the fall when sap movement is downwards.

Spot gun treatment

In this application method, a predetermined volume of herbicide is applied in a spot on the ground. The herbicide used must be soil active (i.e., hexazinone). The herbicide is applied either undiluted or in a concentrated solution. Spots must not be applied closer than one metre from desired conifer seedlings or injury may result.

Tree injectors (hypo-hatchets)

With this method, herbicide is injected into the tree bark with a special "hatchet" or injector (Ezject) that penetrates the bark and releases a systemic herbicide. This application method is very time-consuming and is used mainly for the control of the occasional suckering trees on the edge of a treatment area or to control mature broadleaf trees before harvest of conifers, where the broadleaf trees are sparse.

Frilling

In frilling a tree, the bark is cut in various patches around a problem tree and the herbicide is applied to these cut areas. This method is very similar to the tree injector method and it is used in similar situations.

Stump treatment

Stump treatment involves a herbicide application to the cut stems immediately after mowing or slashing. 2,4-D is the herbicide most commonly applied. This is done to prevent suckering and it may be carried out as a broadcast application where suckering species are dense. In applications using water as a carrier, applications should be made immediately after cutting. Where a petroleum distillate is used as a carrier (ie. diesel), applications made up to 12 hours after cutting give the best results. Herbicide solutions should be applied so that they run down the cut stem and contact crown buds (to prevent coppicing). Where vegetation is not particularly dense, a pre-cut basal treatment may proved more effective control (live trees have better translocation potential than cut stems).

Granular applications

As with spot gun treatments, only soil active herbicides can be applied in this manner (ie hexazinone). The herbicide is applied using granular application equipment that distributes the granules uniformly. Granular applications are sometimes chosen over foliar applications because there is less drift associated with granular applications.

If site preparation is required, the aim is to decrease vegetation competition so that seedlings can be planted, survive, and grow in a good growing environment.

Herbicide should be applied when dominant problem plant species are most susceptible to the herbicide and when desirable species are relatively resistant or will sustain little damage.

Early foliar sprays (spring)

Early foliar spraying occurs after the leaves are fully formed in the spring. The following are some of the advantages and disadvantages of early foliar spraying:

- Most plant species are susceptible to herbicides during the active growing period;
- Poor time for conifer release because conifers are susceptible to herbicide injury;
- Effective time for site preparation.

Late foliar sprays (summer)

Late foliar spraying occurs in the summer. Some of the advantages and disadvantages include:

- Deciduous trees and shrubs are less susceptible to herbicide than early foliar spraying;
- Conifer resistance to herbicides increases, however, herbicide injury may still occur until the buds have hardened off.

Fall foliar sprays (August to mid-September)

Fall foliar spraying occurs after the leaf buds have formed and hardened off. Some of the advantages and disadvantages include:

- Best time for conifer release as there is little chance of any herbicide injury to conifers.
- Deciduous trees and shrubs are less susceptible to herbicide at this time, however, spraying can still be effective until leaf abscission occurs. Grasses and weeds are still susceptible to herbicide.
- Narrow application window (sufficient leaves must still be present on the vegetation to ensure uptake of the herbicide while ensuring crop trees have hardened off sufficiently to tolerate the herbicide).

E. LAND AND FOREST SERVICE REQUIREMENTS

(1) Guidelines for the Use of Herbicides for Silviculture in Alberta

A number of tools are necessary to support various silvicultural systems. Herbicides are one silvicultural tool that may be used to manage forest vegetation to achieve specific forest management goals. Generally they are used to reduce competition from non-crop vegetation during site preparation and stand tending operations. The objective is to establish, maintain and/or improve the growth of desired tree species.

Forest vegetation management practices, including the use of herbicides, require careful consideration of all forest management objectives (eg. crop tree species, wildlife, recreation, watershed, grazing) and all vegetation management options available to meet these objectives in an environmentally sound manner.

Land and Forest Service (LFS) supports the responsible use of herbicides for forest vegetation management on public lands in accordance with provincial and federal legislation and the following provincial guidelines. In accordance with the National Forest Strategy, LFS supports the continuous movement towards the use of alternative vegetative management control methods including non-chemical approaches and biological controls where appropriate. The maximum area that can be treated with herbicides for forest management is set by the Minister of Environmental Protection. In 1999 it was set at 35, 000 hectares.

I. Site Preparation

Herbicides may be used to prepare a site for artificial or natural regeneration of desired tree species under the following conditions:

1. when control of grass is required to reduce competition that, if left untreated, is capable of causing seedling mortality or significant growth loss; particularly in the first years of seedling development.
2. to inhibit sprouting or suckering of non-crop, woody vegetation that is widespread, or has the potential to become widespread, and is in or may be in sufficient abundance to dominate the site and limit the success of reforestation or afforestation efforts;
3. for desiccation of non-crop woody vegetation to facilitate prescribed burning;
4. before a stand is harvested through stem injection, or spot, band, or broadcast application to reduce the sprouting or suckering of competitive, non-crop, woody plants;
5. when mechanical site preparation equipment or the application of prescribed fire will contribute to site degradation, excessive site disturbance or destruction of advanced growth;

II. Stand Tending

Stand tending (eg., cleaning, weeding, and spacing) improves the survival, growth, composition and/or structure of a young forest stand by reducing competition from non-crop vegetation.

Tending treatments may be applied to stands to achieve or maintain reforestation standards (including Establishment and Performance Free-to-Grow Standards). Minimum stocking, height, species and free-to-grow standards are legislative requirements of Alberta's Forests Act and are detailed in the Timber Management Regulation and Alberta Regeneration Survey Manual.

Free-to-grow stands include those stands that meet specific stocking and height standards. Crop trees in these free-to-grow stands must be relatively unimpeded in their ability to grow above competing vegetation.

Herbicides may be used when projected stands will not meet free-to-grow standards because of competition from or non-crop woody plants. Herbicide treatments should be confined to the minimum area required to practically and economically accomplish the vegetation control objectives.

III. Minimizing Herbicide Use

Minimizing the amount of herbicide used to successfully achieve free-to-grow status for each treated area is a priority and must take into account site specific conditions. To accomplish this, the following must be considered:

1. alternative silvicultural systems and site preparation treatments that will minimize the establishment of competitive non-crop species. Treatments should be prescribed only after considering the ecological characteristics of crop and non-crop plants that are on or near the site.
2. artificially regenerate or encourage natural regeneration of desired tree species as soon after harvest/site preparation as possible. Delays at this stage often increase the need for later tending treatments.
3. use of vigorous planting stock of appropriate species where fast growing shrubs, hardwoods and/or herbaceous plants or grasses are likely to be a problem.
4. utilization of viable mechanical, biological and manual methods (see Appendix IV).
5. buffer areas (no treatment zones) will be established along environmentally sensitive areas as per label and provincial requirements.
6. landscape/watershed concerns.
7. selective application of the herbicide where the block is stratified.
8. label recommendations and reduced application rates if they can achieve the desired results.
9. herbicide, rate, timing and method of application that are best able to control the target competing species.
10. ground applications, including single tree or spot herbicide treatments, should be utilized where practical and effective.
11. in general, only one herbicide treatment should be required in a rotation. However, authority to treat areas more than once can be approved with sufficient justification.

IV. Wildlife Protection

The forest community is continually changing. Different vegetation communities in a forest exist at different stages in the forest's development. The re-establishment and abundance of different vegetation species may also vary with the type of disturbance. For example, the abundance of grasses, herbaceous plants, and shrubs that begin growing on a site following logging may often be much greater than that which would grow following a wildfire.

Some of these regenerating herbs and shrubs may benefit wildlife. It may constitute food and/or shelter for various wildlife species. It may also encourage those wildlife species which are adapted to these new forest types to begin to move into the area. However, these same herbs and shrubs may compete with and negatively affect the growth of the crop trees. Herbicides can be an effective tool to selectively and temporarily reduce the numbers and growth rates of the competing vegetation. The purpose of this section is to assist the forester in achieving an acceptable balance between silviculture and wildlife goals.

There are potentially two types of effects herbicides may have on wildlife: toxic effects (direct or indirect) or effects due to habitat change. This discussion assumes:

1) the herbicides used in forest management in Alberta are approved by Health Canada, Pesticide Management Regulatory Agency;
2) herbicides will be used according to the label directions and
3) the toxic effects to wildlife from federally approved herbicides are negligible if they are used according to label for forest vegetation management.

This section will discuss how to prevent potential effects on wildlife brought about by changes to vegetation.

Literature reviews, on the use of glyphosate for forest management, offer some direction. There are no studies on the effects of glyphosate on wildlife habitat in Alberta, however, there are useful studies in other jurisdictions. Based on this information and existing knowledge on the effects of other types of habitat changes on wildlife, a *preliminary* set of guidelines has been prepared. Monitoring studies must be completed to gather data so the guidelines can be updated and improved.

These recommendations were written for broadcast applications of herbicide particularly for glyphosate, and relate more to stand tending than to site preparation treatments. The forest manager should apply these guidelines in a landscape context. Where there are only a few cutblocks in a watershed that require treatment with herbicide, for example, the effect on wildlife habitat would be small. However, where extensive treatment of many blocks is required, the overall effect will be much larger and the following guidelines will assist in ameliorating the impact. The forest manager should demonstrate how consideration for wildlife habitat has been factored into the vegetation management plan.

RECOMMENDATIONS:

1) Untreated "Leave Strips":

Objective:
To retain some of the shrubs and other vegetation which may be used by wildlife on the cutblock.

Background:
Many wildlife species benefit from non-crop tree vegetation on regenerating cutblocks. Species such as elk take advantage of the edge effect. They use the cover afforded by the trees in the uncut forest as shelter and the regenerating grasses and shrubs on the cutblock as food. The vegetation adjacent to the uncut forest is probably used most heavily by edge species. Other species use the abundant forage and low cover throughout the block. The purpose of herbicide treatments is to reduce competing vegetation enough to allow crop trees to survive and grow. There must be a balance between these objectives in the vegetation management plan.

Guideline:
Not all vegetation is affected by operational herbicide applications. Some is missed during the application and some may not be affected by the chemical. The amount of vegetation that should be left untreated will depend on wildlife objectives and will be determined as the results of studies and field monitoring become available. It may not be necessary to establish a fixed percent of second growth vegetation to remain after the application of herbicide; the determination must be made by putting the project into a landscape context.

2) Staggered Cutblock Treatment:

Objective:
To ensure habitat diversity is maintained over the landscape over time.

Background:

The potential impacts of treating all the blocks in a cutting area will be diminished if the treatment is spread over two or three years. By the time the final application is made, the shrubs and forbs on the blocks that were treated first will have begun to regenerate.

Guideline:
Treatment of cutblocks in a management unit should be staggered, and/or the abundance and alternative sources of habitat and cover should be considered. The objective is to provide some untreated second growth vegetation on the cutblocks for wildlife utilization. Alternate blocks may be treated within a two or three year interval rather than treating all blocks at the same time.

3) Snags and Other Trees Protected for Wildlife:

Objective:
Snags and unmerchantable trees retained for wildlife during the harvesting process should not be lost through silvicultural activities.

Background:
Forest managers realize the value of snags and other trees left on the blocks to wildlife. Such trees are often removed during scarification. Snag management must be coordinated with the silvicultural plan if snags are to be successfully retained. The same principle applies where herbicides are to be applied. By coordinating the two plans, the design could be modified to accommodate both.

Guideline:
Herbicide treatment of snags and other trees retained for wildlife should be minimized. In some cases, however, some snags may have to be removed to increase safety of herbicide applications and to prevent excursions.

4) Timing of Stand Tending Treatments:

Objective:
Protect non-target plants for wildlife habitat and nesting birds.

Background:
Applying herbicides late in the season allows herbaceous vegetation and berry producing plants to set seed and begin to enter the dormancy phase. This will allow these non- target species to achieve a higher survival rate. It also allows small birds to fledge.

Guideline:
For stand tending treatments, apply herbicides as late in the season as practical depending on factors such as herbicide, crop tree, target species, and environmental conditions.

5) Buffers:

Objective:
To minimize the effect of herbicides on watercourses and standing water and the organisms that inhabit them.

Background:
The importance of keeping the herbicide from streams and ponds has been addressed in the Alberta Environmental Protection and Enhancement Act, Pesticide Regulations. The vegetation along streams and other water bodies is particularly important for many wildlife species. For example, riparian vegetation provides shade to small watercourses, which in turn provides cooler water temperatures favoured by many fish species in Alberta. Also, normal leaf drop into streams

in autumn may be an important nutrient source for scavenging invertebrates.

Guideline:
Where vegetated buffers along open bodies of water (as defined in the Alberta Environmental Protection and Enhancement Act, Pesticide Regulations) or other buffers have been retained, this vegetation must be protected from the accidental application of herbicide. Vegetation control should also be avoided on sites that depend on live root systems for site and soil stability.

Filling the Data Gaps:
The above recommendations are general because information on the effect of herbicides is evolving. With the new knowledge, improvements to the guidelines will follow. One example of the type of information required is the operational trials, data collection and analysis required to confirm the amount of vegetation left after normal treatment of a block and whether this is adequate for wildlife needs.

V. Additional Considerations

In addition to the above, the following factors should be considered before prescribing herbicides:

- beneficial aspects of non-crop vegetation (such as wildlife habitat, range, recreation, soil protection, nutrient cycling, or seedling protection) should be considered on each site. Herbicide use may conflict with other management objectives. Vegetation management prescriptions should seek to optimize the balance between the positive and negative effects of non-crop vegetation within the context of the silvicultural objectives. Appendix III details guidelines for wildlife protection.
- impact on deciduous growing stock (treatment must be consistent with applicable management plan and reforestation standards)
- manual cutting or other alternatives to herbicides may be appropriate in some situations (eg. aesthetics, public concerns, wildlife concerns).
- good communications with the public, including neighbouring landowners and land users, is vital to a successful vegetation management program.
- on sites where the number and/or configuration of streams in the block makes it difficult to adhere to buffer strip regulations, ground application of herbicides or other alternative treatments should be considered.
- supporting documentation to justify herbicide treatments must be provided by the proponent.

VI. Herbicide Application

All herbicide applications must follow the requirements established by the pesticide products label, regulatory agencies (ie., Department of Environmental Protection - Alberta Environmental Protection and Enhancement Act, Pesticide (Ministerial) Regulation AR 43/97 Pesticide Sales, Handling, Use and Application Regulation AR 24/97 and Environmental Code of Practice for Pesticides; Water Resources Regulation), and government and industry policies and procedures. (eg. these Guidelines).

VII. Methods of Application

1. AERIAL - helicopter only

The following herbicides may be applied by aerial application methods:

1.1 Glyphosate and triclopyr may be applied operationally;
1.2 Herbicides registered for forestry use in Canada by aerial methods where the herbicide is being applied for evaluation purposes in accordance with an evaluation plan developed by the proponent and authorized in writing by a designated employee of Environmental Protection, Land and Forest Service;
1.3 Experimental herbicides that are being tested for forest management registration in accordance with research permits issued under the Pest Control Products Act (Canada) and an evaluation plan developed by the proponent and authorized in writing by a designated employee of Environmental Protection, Land and Forest Service.

2. GROUND - mechanical/manual

The following herbicides may be applied using ground application methods designated on pesticide labels as follows:

1.1 Glyphosate and triclopyr may be applied operationally;
1.2 Herbicides registered for forestry use in Canada where the herbicide is being applied for evaluation purposes in accordance with an evaluation plan developed by the proponent and authorized in writing by a designated employee of Environmental Protection, Land and Forest Service;
1.3 experimental herbicides that are being tested for forest management registration in accordance with research permits issued under the Pest Control Products Act (Canada) and an evaluation plan developed by the proponent and authorized in writing by a designated employee of Environmental Protection, Land and Forest Service.

VIII. Evaluation Programs

Evaluation programs are required for herbicides that are currently not approved for operational use in Alberta. Evaluation programs must incorporate bonafide experimental design and address current data gaps. Land and Forest Service (Forest Management Division) must approve all evaluation projects prior to treatment.

IX. Genetic Programs (Seed Orchard and Progeny Sites)

Land and Forest Service approval is not required for herbicide treatments on genetic experimental and seed orchard sites on public land. Companies and Land and Forest Service, however, must notify Forest Management Division with respect to the hectares to be treated and report these herbicide programs as per Section XIV. The hectares treated on these sites will be included in the annual provincial total.

X. Operational Programs

In order to provide the opportunity for forest managers to develop expertise for the use of herbicides as a tool in forest vegetation management, annual limits are placed on each proponent's herbicide program. This 'go slow' approach will also provide the opportunity to build public confidence for the use of herbicides.

For the purposes of proposing and recording the number of hectares treated, 1 hectare treated equals one hectare, regardless of the type of treatment method (spot or broadcast).

In year 1 to year 3 of a proponent's operational program, the total area treated annually by each proponent will be limited. In the first year of an operational program, treatment area will not exceed 100 ha. In year 2 and year 3, treatment area will not exceed 300 ha and 700 ha respectively. In subsequent years, treatment area will be limited based on sections III and IV of these guidelines. If the proponent is unable to complete year 1 or year 2 of the program (not both), because of factors beyond their control (eg. weather), they may move up to the next increment .

Land and Forest Service (Area Office) must approve the proponent's operational project prior to treatment. Land and Forest Service (Forest Management Division) must approve Land and Forest Service operational projects prior to treatment.

XI. Public Involvement/Notification (refer to Appendix IV - Section 1.7 for more details)

The proponent is required to hold public involvement programs (such as open houses, meetings, tours, office visit) for projects that are greater than 20 ha (excluding genetic experimental and seed orchard sites). The need for public meetings or open houses will depend on the proponent's experience with herbicides as well as the location and past history of herbicide use in the area.

The public involvement plan must be submitted with the herbicide proposal. The proponent must advertise their public involvement program in the local newspaper. In cases of overlapping tenure, the herbicide proponent must also give the other tenure holder the opportunity to provide comments. As indicated earlier (V. Additional Considerations)the impacts on deciduous growing stock must be addressed and should be consistent with the applicable management plan.

If the program is approved by Land and Forest Service, a second advertisement in the local newspaper is required to notify the public that the proponent has received LFS approval and will be going ahead with the proposed treatments.

All private land holders, public land disposition holders, trappers and anyone directly affected who are in or adjacent to the proposed treatment area must be contacted prior to start of project, as outlined in Section 11(5) of the Environmental Code of Practice for Pesticides.

XII. Appeal Process

Disputes will be reviewed by the Regional Director. If the dispute cannot be resolved at the Regional Director level, it will then go to a formal appeal with the Forest Management Division director. The Forest Management Division Director's decision is final and binding.

XIII. Project Monitoring

There are standard longer term, monitor procedures for most forest herbicide treatments. (See section K).

1. Operational treatments

Standard monitoring of operational trials will provide valuable information on forest herbicide programs in Alberta. The information must be collected by the proponent according to standards and methodology approved by Land and Forest Service (refer to the Operational Herbicide Monitor Program Manual). The main objectives of the monitor program are to evaluate the effectiveness of herbicide use in achieving silvicultural objectives (ie. control of target vegetation, crop tree survival and growth) and to monitor change in plant species composition.

2. Evaluation trials

Trials that address gaps in herbicide research must include a bona fide experimental design.

3. Genetic sites

A standardized monitor program is not required for herbicide treatments on genetic sites (experimental and seed orchard sites).

XIV. Additional Reporting Requirements

1. Incidents such as spills; outside label application; off target, non prescription effects; and all excursions observed during treatments must be reported immediately to Land and Forest Service, Area Office who will notify regional Environmental Service staff.
2. Three copies of the Post Treatment Monitor Report for other excursions must be submitted to the Land and Forest Service Area Office by July 15, of the year following treatment unless otherwise agreed to by Land and Forest Service (refer to Appendix IV, Section 1.4 for details). Land and Forest Service Area Office will forward one copy of the report to Forest Management Division and 1 copy to Pesticide Management.
3. Pesticide Management will include incidents in the Incident Tracking System that are contraventions or suspected contraventions of the Environmental Protection and Enhancement Act or the Pesticide Regulations. This system will be used to build a historical data bank and to track incident occurrences.
4. In addition to the standard reporting requirements for silviculture treatments, the proponent must submit the following to the local Land and Forest Service Area office, by November 30 of each year:

    a. two copies* of the Program Summary Report which includes the following:
        - product used (trade name) and the Pest Control Products registration number
        - amount of product used
        - number of hectares treated
        - location of treatment (legal description, disposition)
        - application method (broadcast ground; selective ground; aerial)
        - treatment objective (site preparation versus stand tending)
        - treatment type (operational vrs evaluation)
        - location of mix and load sites

    b. one copy** of the operational herbicide monitor program data.

This information will be included in the provincial and/or national data base.

* LFS Area Office will retain one copy and forward one copy to Forest Management Division.
** LFS Area Office will forward the copy to Forest Management Division.

(2) Planning and Approval Process:

The objective of this section is to provide an outline of herbicide proposal requirements and the approval process. The more thorough the proposal, the quicker the review/approval process.

1. Herbicide Proposal Requirements for Operational and Research Projects (proposals are not required for herbicide treatments on genetic experimental and seed orchard sites).

1.1 Treatment Objectives - identify purpose of treatment (consider the objectives of the applicable management plan and regeneration standards, and other values and objectives):

i) Conifer Release/site preparation.
ii) Operational/research.
iii) Control of specific competition.
iv) Wildlife and other values (eg. deciduous growing stock) considerations - include mitigative measures and incorporate provincial guidelines.

1.2 Description of Treatment Area:

i) General Description of Treatment Area:

a) Treatment area and location (legal description, disposition).
b) Maps or aerial photos (no larger than 1:20,000).

ii) Individual Block Descriptions:

a) Block treatment history. Block history should include SRMS information such as harvest year and prior silvicultural treatments.
b) Site description. When soil residual herbicides (hexazinone) are proposed, a detailed site description including soils information (texture, duff, coarse fragments, classification), topography (slope, aspect), water table and drainage and ephemeral watercourses are required.
c) Watercourses - permanent and intermittent watercourses and buffers must be mapped:
d) Sensitive areas (eg. traditional berry picking areas, wildlife, recreation areas, soil erosion or slumping areas).
e) General description of competing vegetation and crop trees (ie. stocking, density, height and species).

1.3 Access Requirements

Identify the access routes. Identify watercourse crossings that must be reestablished.

1.4 Monitor Requirements for Excursions / General (visual) Observations

1.4.1 Post-Treatment Monitor Plan

The proponent will submit a post treatment monitor plan for excursions and general (visual) observations that details the timing and the number of treated blocks to be audited. The plan should also identify monitoring of those sites where the potential for a problem is perceived to be greater than normal (eg. stream buffers, irregular boundaries, unfavorable atmospheric conditions).

Unless otherwise agreed to by Land and Forest Service, excursions/observations noted during the post spray monitoring must be reported no later than July 15 of the year following treatment.

In year one of the proponents operational program, 100% of the treated blocks should be monitored; in year two, 50%; year three, 25%; year four, 10%; year five onward, as stated in the post treatment monitor plan. If circumstances change, (eg. equipment or contractor), more blocks should be monitored. The level of monitoring may also increase based on past history. For example, if proponent/applicator has a history of excursions, the proponent may have to monitor 100% of the blocks.

1.4.2 Reporting of Excursions/General (Visual) Observations

All excursions that are observed during or after the application must be reported immediately to Land and Forest Service, Area Office who will notify Forest Management Division and Environmental Services Division.

The proponent will provide the following information regarding excursions dependent on the nature and extent of impact:

- location and size of damaged areas (including legal land locations and maps)
- the type and extent of vegetation damage by species with photo documentation
- type and extent of damage to non-vegetation resources (soil, water bodies, wildlife, etc.)
- an explanation of how the excursion might have occurred, and recommendations for mitigating any damage or other environmental concerns at excursion sites. This information will be submitted on the Incident Reporting Form provided by Land and Forest Service.

Regional AEP staff, Forest Management Division and/or Land and Forest Service Area Office, along with the proponent, may view reported excursions. The proponent will then send Land and Forest Service Area Office 3 copies of a letter that details how they intend to minimize the chances of similar excursions occuring on future programs. LFS Area Office will retain one copy and forward one to Forest Management Division and one to Regional AEP staff.

1.5 Review of Alternatives:
Block by block treatment recommendations and justification. Include biological, social and economical considerations and limitations of alternatives. Blocks can be grouped if they are to be treated identically and have the same justification.

1.6 Treatment Methodology, Rates, Timing, and Logistics:
Block by block description of treatments, methodology, rates, timing, and logistics, such as potential mixing and loading sites, is required.

1.7 Public Involvement and Notification Requirements:
The proponent is required to give the general public the opportunity to review and provide input on proposed herbicide programs that are greater than 20 hectares.

In cases of overlapping tenure, the herbicide proponent must also give the other tenure holder the opportunity to provide comments. Input of other tenure holders must be obtained early enough in the process so appropriate input may be addressed in the development of treatment prescriptions. Public involvement and notification is not required for projects less than 20 hectares and on genetic tree improvement sites.

a) Public Involvement: Public involvement programs (such as open houses, meetings, tours and office visits) must be scheduled to allow the public adequate time (a minimum of 30 days) to forward any specific concerns and comments about the proposed project.

The proponent must prominently advertise their public involvement program in the local newspaper. The advertisement must be made a minimum of one week prior to the public involvement. The advertisement must identify that the program proposes to use herbicides; the area/location for the proposed treatment; the application method; and the timing of the application.

The company must contact the LFS Area office at least two weeks prior to the public involvement program regarding the date and location of the public involvement program. Land and Forest Service staff will monitor the program to ensure that all legitimate public concerns are addressed.

Land and Forest Service's objective will be to approve or reject the proposal within 14 days after the 30 day period allowed for public response. If there are no legitimate concerns, or the concerns have been adequately addressed by the company, LFS may approve the project. Ideally the public involvement program would be completed after the proponent submits the proposal to LFS for review.

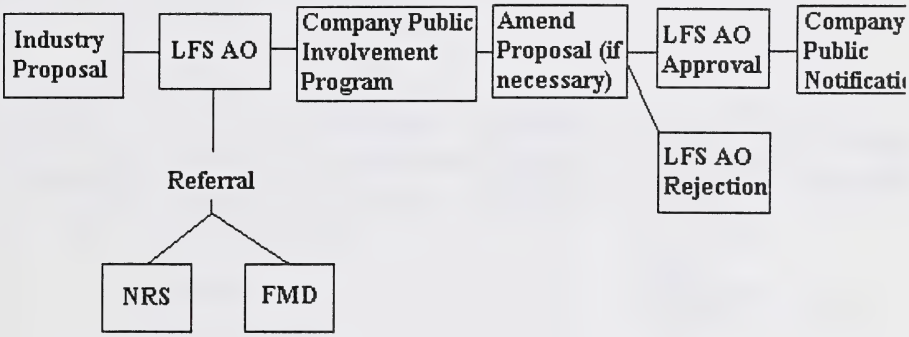
b) Public Notification: If the program is approved in writing by LFS, a second advertisement in the local newspaper is required. The company must notify the public of the purpose and scope of the approved project in one or more local newspapers a maximum of 90 days and a minimum of 72 hours prior to the commencement of the herbicide project. The advertisement must include notification of approval, timing and location of the program, application method, and type of herbicide.

All private land holders, public land disposition holders, trappers and anyone that may be directly affected who are in or adjacent to the proposed treatment area must be contacted prior to the start of the project.

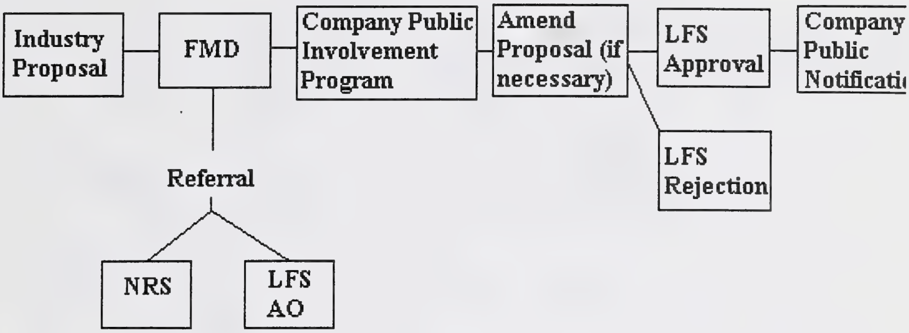
1.8 Monitoring Reporting Plan:

As per provincial guidelines for operational and evaluation projects.

- Industry Operational Projects:


Industry Proposal
LFS AO
Company Public Involvement Program
Amend Proposal (if necessary)
LFS AO Approval
Company Public Notificati
LFS AO Rejection
Referral
NRS
FMD

- Industry Evaluation Projects: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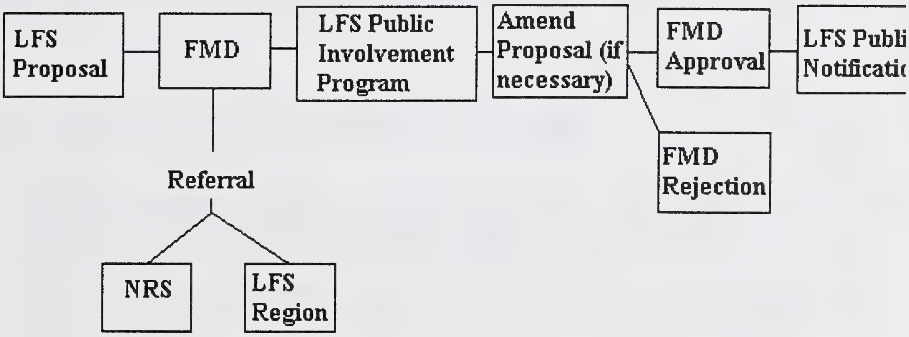
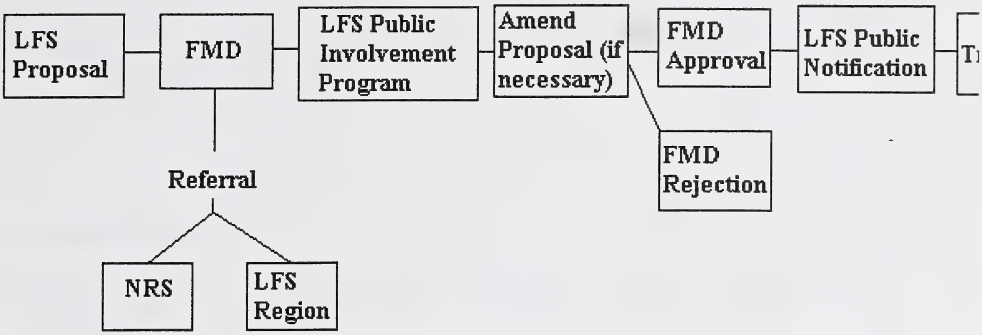
Company Public Notificati
LFS Rejection
Referral
NRS
LFS AO

- Land and Forest Service Operational Projects:



- Land and Forest Service Evaluation Projects:



NOTE: Public Involvement/Notification required for projects that are greater than 20 ha.

FMD = Forest Management Division; **Region** = Regional Headquarters; **AO** = Area Office;

2. Approval Process for Operational and Research Programs

2.1 Timing:

a. Forest Management Division (attention Rob Kesseler - 422-4568) must be notified by December 30, regarding the number of hectares each company/region anticipates treating the following year.
b. Land and Forest Service must be allowed a minimum of 30 days to review the proposal. It is preferred that the proposal is submitted to LFS prior to public involvement.
c. Industry operational proposals are submitted to the Area Manager. Land and Forest Service operational proposals are submitted to Forest Management Division. Industry and LFS research proposals are submitted to Forest Management Division.
d. Proposal must include details described in #1.
e. Proposals may be referred to other agencies (eg. Fish and Wildlife) for comments.
f. Land and Forest Service's objective will be to approve or reject the proposal (in writing) within 14 days after the 30 day period allowed for public response.

3. Approval Process for Genetic Sites

Herbicide projects on genetic experimental and seed orchard sites are excluded from the LFS approval and public involvement/notification process. The intent of the Environmental

Protection and Enhancement Act and Regulations, with regards to herbicide treatments on genetic sites, is that genetic sites are not included in the definition and requirements for Woodlands and Forests.

Proponents, however, must notify Forest Management Division with respect to the area to be treated and report these programs according to section XIV of the "Guidelines for the Use of Herbicides for Silviculture in Alberta".

(3) Letter of Authorization

Approvals for all components of the herbicide plan must be in writing. The format for a standard Letter of Authorization is as follows:

DATE

Dear Proponent:

RE: HERBICIDE PROJECT AUTHORIZATION

Department of Environmental Protection staff have reviewed your herbicide project proposal dated __ and have authorized this project in accordance with the latest edition of Guidelines for the Use of Herbicides for Silviculture in Alberta, published by Alberta Environmental Protection, subject to the following conditions:

1. All herbicide treatments must be conducted by a Registered Pesticide Service in accordance with all applicable federal, provincial and municipal legislation. Any questions regarding the regulatory requirements of Registered Pesticide Services can be directed to Pesticide Management of Environmental Protection (Mr. Neil Wandler 427-0054).
2. The proponent's name must ensure that the public has been advised of the purpose and scope of the project by means of a notice published in one or more newspapers within the vicinity of the proposed treatment sites a maximum of ninety days and a minimum of 72 hours prior to the commencement of herbicide treatments.
3. Prior to commencement and upon completion of the project Land and Forest Service, ________________ Area Office (phone number) must be notified.
4. Proponent's name must identify an authorized representative that will be cognisant of the herbicide project and available on site while herbicide treatments are being conducted.
5. All herbicide treatment locations, areas, pesticides used, application methods, application rates, and application time frames are restricted to those identified in the project proposal submitted by (proponent & contact name) and reviewed by the Department of Environmental Protection in consideration of this Herbicide Project Authorization.
6. The Certified Pesticide Applicator responsible for supervising pesticide mixing must be in possession of a copy of this Herbicide Project Authorization and a copy of the corresponding project proposal while herbicide treatments are being conducted in accordance with the latest edition of the Environmental Code of Practice for Pesticides published by Alberta Environmental Protection.

7. The locations of mixing/loading sites that are not within proponent's name disposition must be authorized by Land and Forest Service, ___ Area Office prior to use.
8. Proponent's name must establish one vegetation management monitoring plot within the herbicide project. The plot must be established, measured and results reported according to the standards in the latest edition of the Operational Herbicide Monitor Program Manual published by Alberta Environmental Protection.
9. Proponent's name must monitor areas for off-target herbicide impacts in accordance with the monitoring plan included in the project proposal submitted by *proponent & contact name* and reviewed by the Department of Environmental Protection in consideration of this Herbicide Project Authorization. Any excursions identified must be reported to Land and Forest Service, ___Area Office on or before ___ in accordance with the requirements stated in the Guidelines for the use of Herbicides for Silviculture in Alberta.
10. All water course crossings required for ground access herbicide treatments must comply with Section 3.4.3 of the Alberta Timber Harvest and Operating Ground Rules, recognizing instream timing constraints for installation and removal. All stream crossings installed must maintain clean water for their tenure.
11. A summary of the Herbicide Program stating the quantity of herbicide used, dates of treatment and amount of area treated or any other information requested must be forwarded to Land and Forest Service, ____ Area Office by November 30, 199_.

Should you require any further clarification regarding this authorization letter, please contact ____ at ____.

cc: Wildlife Biologist
Area Manager
Neil Wandler - Environmental Service, Pesticide Management
Rob Kessler - Forest Management Division

F. CRITICAL SILVICS

In order to properly plan a herbicide project it is important to understant the phenology, growth habitat, nutrient, light and moisture requirements of both the competitive and the crop tree species. It is important to understand their response to disturbances both mechanical and chemical. The main conifer crop species of concern are:

White Spruce *(Picea glauca)*
Black Spruce *(Picea mariana)*
Jack Pine *(Pinus banksiana)*

The major competitive species include:

Graminoids (grasses and sedges especially *Calamagrostis canadensis)*
Balsam Poplar *(Populus balsamifera)*
Trembling Aspen *(Populus tremuloides)*
Prickly Wild Rose *(Rosa acicularis)*
Wild Red Raspberry *(Rubus idaeus)*
Willows *(Salix spp.)*

A good source of information is a report entitled "**Critical Silvics of Conifer Crop Species and Selected Competitive Vegetation in Northwestern Ontario**" (CRFRDA Report 3310 (NWOFTOU Technical Report 19). This report was written by F. Wayne Bell and funded under The Canada-Ontario Forest Resources Development Agreement.

G. LFS Prescription Evaluation for Forest Management Projects

(1) Herbicide Project Evaluation Methods

During Phase I and Phase II reviews keep in mind the considerations identified in the **"Guidelines for the Use of Herbicides for Silviculture in Alberta"** document. (I. Site Prep, II. Tending, III. Minimizing Herbicide Use, V. Wildlife Protection, IV. Additional Considerations).

Phase I - Preliminary information: List and maps of potential blocks

1. Consult with appropriate Alberta Environmental Protection staff - for their assessment of: environmental concerns, watercourses, steep slopes, vegetation competition
2. Review photos - watercourses/steep slopes, clues to vegetation competition, previous cover type
3. Review harvest records/consult/photos for:
    - Understory spruce protection
    - Oversized spruce blocks where hiding cover is important
    - Roadside vegetation/aesthetic concerns
    - Older (>15 years) blocks with grass/aspen competition
    - (Height & density in relation to one another)
    - Review vegetation competition/crop tree information for information submitted
    - Summary table - look for anomalies re: survival vs. FTG vs. EFM
      eg. Competition other than grass & aspen - raspberry/forbes/lab tea/alder Stems/ha
    - Pine/aspen vs. Spruce/aspen mixes
    - Consult with Fisheries/Wildlife Biologists to ensure that concerns have been addressed according to Guidelines for Wildlife Protection.
    - Discuss concerns/incomplete information with company.

Phase II - More intensive review: Complete detailed information

1. Further review updated/enhanced vegetation competition/crop tree information
    - Summary table - look for anomalies re: survival vs. FTG vs. EFM
    - Request company for Individual block tally sheets for anomalies
2. Request company for loan of their photos - Stratification/creek concerns
3. Field visit anomalies/Fish & Wildlife concern areas where concerns are still possibly evident and not satisfied in the review of information identified. Also visit a sample of non-concern blocks.

Phase III - Preparation of Conditions: Approved/Reject Blocks for Approval Letter

1. Review the "Guidelines for the Use of Herbicides for Silviculture in Alberta" document to ensure that company has met all requirements. eg. Public Involvement/Notification, Project Monitoring (use Herbicide Proposal Requirement Checklist).

(2) Herbicide Proposal Requirement Checklist

Requirement	**Met✓ Not Met X**	**Comments**
Company Experience		
Treatment Area Limititations		
Objectives		
Descriptions of Treatment Area-General Description		
Maps/aerial photos		
Wildlife considerations - provincial guidelines/migitative		

measures		
Untreated leave strips		
Staggered cutblock treatment		
Snag/unmerch tree protect		
Application timing		
Buffers		
Location/area-Blocks/disposition		
Descriptions of Treatment Area-Individual Block Descriptions		
Block Treatment History (SRMS)		
Site Description		
Watercourses *Permanent/int-buffer requirements		
Watercourse special use approval		
Public Sensitive areas		
Competing vegetation/crop tree description		
Review of Alternatives Recomendations/justification(Biol/social/economical)/limitations of alternatives)		
Treatment Methodology		
Rates/timing/logistics		
Ground access-watercourse xings/fish timing considerations		
Logistics-Potential mixing/loading sites		
Public Involvement/Notification		
Monitoring Reporting Plan		
During operations		
Short term follow up for excursions		
Long term monitoring (Operational monitor plot program)		
Prescription Validation (use Herbicide Project Evaluation Methods Document)		

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Appendix I (cont.) | **Appendices (cont.)**

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forests

Alberta
ENVIRONMENT

H. RISK MANAGEMENT PROVISIONS FOR AERIAL HERBICIDE APPLICATIONS FOR FOREST MANAGEMENT

Risk is defined as "chance or possibility of danger, loss, injury or other adverse consequences". With respect to herbicide use, risk can generally be categorized into two different types:

1) Herbicide Release - an unauthorized release due to spills, leaking equipment (nozzles/booms) or applications to an area not approved.
2) Off target Site Pesticide Excursions - movement of the herbicide off of the approved application s due to airborne particle drift or movement through the soil.

Through experience and continual developments in equipment technology, risk management techniques can be incorporated into spray programs to minimize risk. The following points are **suggested** risk management techniques.

Equipment

Tank Systems

- Use of professionally assembled hoses with camlock ends to prevent them from loosening.
- Designing the tank system so it does not have to be removed for the maintenance of the aircra
- Use of a secondary "system" pressure gauge or "kill switch" to either inform the pilot of blown lines or shut the spray system down when a line blows.

Nozzle and Boom Configurations and Calibration

- Use of Accu-flo® or other low drift booms.
- Ensuring a median target droplet size of 250 microns at the target vegetation (for Vision Herbicide). Note: Median target droplet sizes may be different for other herbicides (check with the manufacturer for recommendations).
- Ensuring the aircraft has been through a calibration and patternation clinic in either British Columbia or Alberta.

Other Technology

- Use of Global Positioning Systems (GPS) technology to assist the pilot and help reduce errors judgement for boom "on" and boom "off" calls (particularly along watercourses, block edges, and other sensitive locations).
- Use of adjuvants such as Sylgard®.
- Use of registered drift control agents.

- Use of other technology (ie. smoke generators to detect the presence of unusual weather conditions such as temperature inversions).

Pre-Spray Meetings

- Forest companies should hold pre-spray meetings with contracted Pesticide Services to ensure personnel involved with the spray program are familiar with safety and all other aspects of the program (i.e. interpretation of flagging, etc.). Land and Forest Service or Natural Resource Service staff may also be invited to provide input.

Reconnaissance Flights

- A reconnaissance flight should occur before each application to ensure the pilot is familiar wit the blocks and is cognisant of sensitive areas within each block. Sensitive areas should be marked on the pilot's map of the blocks. An automatic flagman can be used to mark hard to se areas such as steep slopes and hidden watercourses prior to application.
- A "Bird Dog" aircraft may also be used to assist in avoiding sensitive areas.

Perimeters

- Block perimeters should be treated first in the morning or last in the evening (when winds and humidity conditions are generally more favourable).
- Perimeters should be as free as possible from hazards (i.e. snags) to ensure safety for the pilot and to allow the helicopter to fly lower along the perimeter to minimize drift potential.

Buffers (adjacent to sensitive areas - i.e. watercourses, forest edge)

- Buffers for specific aircraft and equipment can be determined with assistance from the AGDIS computer spray drift model.
- The standard buffer distance used along sensitive areas is one half of one swath width (18-27 metres). Maintaining this buffer will usually result in a 2-3 metre no observable impact zone around protected areas.
- Buffers must be extended where a wider no observable impact zone is required (i.e. a 5 metre observable impact zone for Vision applications that are not approved under a Special Use Approval).
- Buffers should be flagged (especially along watercourses) to ensure thay are clearly visible to pilot.
- Buffers should be treated first in the morning or last in the evening (when winds and humidity conditions are generally more fabourable).
- Buffers should be as free as possible from hazards (i.e. snags) to ensure safety for the pilot and allow the helicopter to fly lower along the buffer edge to minimize drift potential.

Block Monitors

- At least one crew-member should be on the ground and in each treatment block ahead of helicopter equipment.
- The block monitor's function is to remind the pilot of sensitive areas on the spray block and to relay wind and relative humidity information to the pilot as needed. Monitors should carry a

sling psychrometer, wind gauge, and binoculars. Monitors should be trained to observe wind speed using leaf and twig movement as indicators.

Environmental Factors

Wind

- When there is no wind (dead calm), pilots should use smoke-generating equipment to check fo inversion. If an inversion is present, spraying should stop until the conditions change.
- It has been suggested that an 8 kph wind speed maximum should be considered if no snags are present on the treatment. A wind speed of 4 kph should be considered where snags occur. However, unless otherwise indicated on pesticide product labels, there are no provincially legislated maximum windspeeds above which spraying must not occur.

Temperature and Relative Humidity (RH)

- At an air temperature of 15°C, a minimum RH of 50% is recommended.
- For temperatures between 15° and 25°C, and RH of 55% - 60% is recommended.
- Spraying is not recommended when the temperature exceeds 25°C.

Post-treatment Block Inspections

- Post treatment monitoring must be conducted by forest management companies/government agencies in the growing season immediately following application.

NOTE: This information is provided for the benefit of personnel in developing and conducting aerial herbicide application programs. Greater awareness by forestry personnel of risk management provisions will help ensure quality pesticide application services will be delivered. This section of the manual will updated from time to time as knowledge of risk management techniques becomes further defined and improvements in technology dictate.

Standards for Pesticide Services are set by government agencies through regulation and regulatory Code of Practice, and by industry associations through such things as industry Codes of Practice and company policies. Forest management companies should be familiar with regulatory and other industry requireme

I. DURING TREATMENT / POST TREATMENT INSPECTIONS FOR FOREST MANAGEMENT PROJECTS

(1) During treatment; What to Look For

Alberta Environmental Protection Officials have the authority to check for the following when conducti an inspection **during** a pesticide application:

- applicators should be carrying the appropriate class of an applicator certificate with them durin pesticide applications. An inspector can verify whether an applicator has an applicator certific by calling 1-800-661-3495 (Pesticide Certification Information Line). Check to see if the certification class is appropriate for the type of pesticide application being conducted.

- check to see if non certified applicators are properly supervised. The requirements for supervision have been covered earlier in the provincial legislation section.
- the company in which the applicator is performing the pesticide application should have a Service Registration. Verification of Service Registration can be obtained by phoning any one the Environmental Service regional offices.
- check for proper storage at the mixing and loading site. Check to see if the facility is designed contain a spill from moving off the site and that all safety and spill cleanup equipment is available. This is also important for the mixing and loading site.
- check to see if all required information is recorded in the applicator/service registration record

The following inspection sheet can be used as a guide for completing an inspection during pesticide applications. If there are any concerns about the application site, the completed form can be faxed to Ne Wandler at the Pesticide Management @(403) 422-5120 or Rob Kesseler @ (403) 427-0085 for follow-

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TREATMENT INSPECTION SHEET

Date of Inspection:
Service Registration No:
Inspector:
Area Office:
Inspector's phone number:

SERVICE REGISTRATION INFORMATION:

Organization Name:
Address:
Individual Interviewed:

Note: In the following sections a √ means the item meets requirements while an X means it is deficient.

CERTIFICATE HOLDERS: Certificate Holders and Types (Note: for Forest Management Projects, a Forestry class Pesticide applicator certificate holder must be on site at all times).

Name:
Certificate #:
Class:
Number of Assistants:

COMMENTS:

APPLICATION EQUIPMENT: Application equipment description including Aircraft Call Numbers:

MIXING AND LOADING SITE:
Location:
Water source:
Can contain pesticide spills:
Evidence of spillage:
Evidence of off site movement:
Emergency response information:
Personal protective equipment:
Spill cleanup material:

COMMENTS:

SERVICE REGISTRATION/APPLICATOR RECORD KEEPING REQUIREMENTS:
Customer Name:
Date/time:
Application rate:
Relative humidity:
Precipitation:
Wind speed/direction:
Location:
Pest/purpose:
Method of application:
Temperature:
Name of pesticide and PCP #:
Pest/purpose:
Waste container:
Are herbicides being stored in a facility approved by the Pesticide Management Branch?
Location of storage facility:

PUBLIC NOTIFICATION:
Immediately prior to an application, all main access routes shall be posted with signs advising that a pesticide application is in progress. The landowner or the owner's agent shall ensure that the signs remain in place for a minimum of 48 hours following the pesticide application, after which time the land owner or the owner's agent shall ensure the signs are removed.

- Signs posted prior to application
- Signs removed 48 hours after application
- Inspector's Signature
- Applicant Signature
- Printed Name

FAX COMPLETED FORM TO: Neil Wandler at 422-5120 or Rob Kesseler at 427-0085.

(2) Post Treatment Inspections

(a) *Recognizing Herbicide Damage*

Common Causes of Herbicide Damage

Rain shortly after application: Leaching or run-off through soil will be particularly hazardous if heavy rains occur immediately after application.

Inattention to soil characteristics and soil water movement: The potential for various herbicides to move with soil water, particularly in coarse textured soils, is frequently underestimated.

Inadequate buffers: The potential for herbicide movement and for root growth into treated areas is frequently underestimated.

Removal of contaminated soil: Top soil (or gravel) that has been stripped from an area and stockpiled f future use is often treated with herbicides to prevent weed growth. In some cases, treated soil has been distributed for lawns and gardens with disastrous effects. Residual herbicides (residual for more than thr months) should not be used on soil stockpiles, and soil treated with residual herbicides should be posted

Removal of contaminated vegetation: A number of residual herbicides remain active within plant tissue for a long period. Harvesting this vegetation to use as garden mulch could release herbicide. More commonly, contaminated vegetation is fed to livestock and manure becomes contaminated with herbicid residues. Manure is subsequently incorporated into gardens or ornamental beds causing damage to plant

The use of systemic herbicides on tree and shrub "suckers": A number of tree and shrub species reproduce by developing new stems from the roots of a parent plant. These new stems are referred to as "suckers" and they can be seen around the base of a number of trees and shrub species including various poplar, lilac, and Manitoba maples. Using systemic herbicides to control plant suckers can result in herbicide translocation and subsequent damage to the parent tree or shrub.

Natural Stress Symptoms

Since plants are seldom grown in conditions where life support factors are ideal, an imbalance may indu stress which results in visible symptoms.

Stress symptoms can be caused by drought, winter dying, flooding, natural senescence, frost, high temperatures nutrient deficiency, and diseases. The symptoms associated with these natural stress factor may be easily mistaken for herbicide damage.

Typical Herbicide Injury Symptoms

Herbicide affected vegetation often displays a distinct pattern while other trees nearby are perfectly healthy. Although herbicide effects on plants vary, related compounds usually cause plants to show a characteristic group of symptoms.

Injury Symptoms on Leaves

Feathering of leaves: This symptom is typical of leaf malformations induced by translocated growth hormone herbicides such as 2,4-D, MCPA, dicamba, and sometimes glyphosate.

Fiddleheading: This pronounced symptom occurs in young growing points of plants. An upward curlin of older leaves is also obvious.`Such symptoms are produced by growth-hormone herbicides such as dicamba and picloram.

Cupping of leaves: A distinct cupping (usually upward) is typical of injury from growth hormone herbicides such as dicamba and picloram.

Chlorosis: One of the more typical injury symptoms of herbicides is the loss of chlorophyll from leaf tissue resulting in many patterns.

Meristematic chlorosis: Chlorosis, which initially occurs in the meristematic regions (growing points) o plants is typical of translocated herbicides such as amitrole, glyphosate or chlorosulfuron. The chlorotic areas may appear almost yellow, white or pinkish in colour.

Veinal chlorosis: Yellowing in the veins of the leaves. This typical injury is caused by triazine herbicid e.g. atrazine, and results from root uptake of the herbicides.

Marginal chlorosis: This symptom occurs as a narrow yellow band almost entirely around the leaf marg It is sometimes called the "halo effect". This symptom can occur from foliar uptake of triazine herbicide
Mottling: This refers to chlorosis which occurs randomly on the leaf. Parts of the leaf remain green whereas others become chlorotic. Injury occurs only on leaves that came in contact with the spray; new leaves that develop afterward appear normal. Contact herbicides such as diquat or paraquate may cause such symptoms.
Necrosis: Death of isolated tissue. It usually follows chlorosis.

Injury Symptoms on the Stems

Epinasty: This term describes the bending and twisting that occurs in either stem or petioles of the plan The response occurs within a few hours after exposure to a herbicide. Growth hormone herbicides such phenoxy (2,4-D, MCPA), benzoics (dicamba) and pyridinecarboxylic acids (picloram) cause such symptoms.
Abnormal stem elongation: Stem elongation of broadleaved plants may be enhanced (at low concentrations) or inhibited (at high concentrations) by growth-hormone herbicides such as 2,4-D, MCP dicamba and picloram.

Diagnosis of Herbicide Injury and Damage

Making an accurate diagnosis of herbicide injury is often difficult if an investigator looks at specimens o dying plants. For this reason, the investigator should actually view the affected non-target vegetation as soon as possible after the damage is reported and should consider the following points:

- **Do not make a snap judgement:** It is important to gather all possible evidence (plant and/or specimens, photographs) and pertinent information before drawing conclusions.
- **Ask a lot of questions pertaining to:**
  a. spraying details such as chemicals sprayed, method of application,
  b. date of spraying
  c. weather conditions before and after spraying.
  d. soil conditions (sandy soil may increase soil mobility of certain persistent herbicide

- **Look for patterns such as:**
  a. condition of unaffected surrounding vegetation
  b. symptoms of disease or insect
  c. injury pattern (strips, drift pattern)
- **Watch for look-alike symptoms. These may include:**
  a. nutrient deficiencies
  b. insect or disease damage
  c. weather related injuries

(b) *Post Treatment Inspection Form*

The main objective of the post treatment inspection is to identify any incidents of herbicide movement (whether through air or ground) off the approved treatment site and to ensure that there is no visible imp from the herbicide within 5 metres of an open body of water (when herbicides listed in the Environment Code of Practice are used for forest management).

The holder of the Timber Disposition is obligated to monitor treatment areas and identify any occurrenc off the treatment site and to report these incidents to the nearest regional Environmental Service office. forest officer may notice areas of herbicide excursions that may or may not have been reported. It is important to notify the nearest regional Environmental Service office of any treatment areas of which yo may have concern, so the appropriate action may be taken.

The degrees of herbicide excursions will vary. If long stretches of vegetation are affected or a water buf violation has occurred then compliance action may be a consideration. If the incident is severe, the area may be re-inspected and the nearest regional Environmental Service office may request the Land and

Forest Officer to attend a joint follow-up inspection (along with pesticide applicator, lease holder, etc.). During the inspection, vegetation samples would be taken of affected vegetation for chemical analysis a a determination may be made in respect to what compliance action would be appropriate.

A post-treatment inspection form can be found on the following page and may assist the Forest officer i reporting any pesticide excursions.

POST-TREATMENT INSPECTION FORM FOR HERBICIDE APPLICATIONS IN THE GREEN AREA OF ALBERTA

Inspector's name:
Location (legal land location if known):
Telephone number:
Leaseholder:
Region:
Area office:
Applicator or contractor:
Date of Inspection:

1. Is there any evidence of offsite movement?
    a. Location & provide a description of type of offsite movement and extent of damage? (ie spray drift; surface movement of residual herbicide, root uptake of herbicide, etc)
    b. Description of damage to non-target vegetation (may include photos of damage area as well as symptoms of damage on vegetation)
2. Is there evidence of any impact from the herbicide applications to any vegetation within 5 metres of water of an open body of water as defined in the Pesticide Regulations?
    a. Location and type of open body of water (name of waterbody if know):
    b. Distance (metres) sprayed from the bed and shore:
       Comments:

   c. General comments of what vegetation is affected and extent.

3. Identify any other non-compliance from the *Environmental Code of Practice for Pesticides* or Pesticide Regulations that may have occurred and the type of violation (ie. pesticide spills, public safety, unregistered use, etc.)

    - Identify any non-compliance of conditions in the letter of authorization issued to the holder of the timber disposition or the Guidelines For the Use of Herbicides For Silviculture in Alberta published by Alberta Environmental Protection. **(Forest Management Herbicide Applications Only)**

    - Is there any over-height woody plant sprayed on a right-of-way :
        a. location:
        b. adjacent to numbered highway:
            (30% of target vegetation cannot be over 1.5 metres) - yes/no
        c. adjacent to a road:
            (30% of target vegetation can not be over 2.5 metres) - yes/no
        d. cross-country rights-of-way:
            (30% of target vegetation can not be over 4.0 metres) - yes/no

4. Has blanket treatment occurred where not warranted? (On rights-of-way where the target vegetation species covers less than 30%, herbicide applications shall be conducted on a selective spot treatment basis. Vegetation management practises to encourage the growth of low growing shrubs on the edges of the right-of-way shall be followed unless these species pose a danger to the operation or maintenance of the right-of-way).

    (a) Description of area and location

Please fax completed form to Neil Wandler of the Pesticide Management Branch @ FAX: (403) 422-5120 or phone for inquiries @ (403) 427-0054 or Rob Kesseler @ FAX (403) 427-0085 or phone (403) 422-4590.

J. ENFORCEMENT PROVISIONS

Regional AEP staff respond to complaints from the general public and other agencies. Other agencies th may be involved in the resolution of these complaints are:

PERT - Pollution Emergency Response Team of Alberta Environmental Protection
Fish & Wildlife - animal poisonings
SPCA - animal poisonings
Land and Forest Service - lease, forestry and right-of-way problems
Alberta Agriculture, Food and Rural Development - primarily agricultural complaints
Municipalities (urban and rural)
Health Canada - product registration and residue assessments
Local Police Detachments - malicious acts

Investigations

AEP conducts investigations into potential contraventions of provincial pesticide regulations. The most common of which are:

- an adverse effect to the environment. Damage resulting from migration of the pesticide from t target area.
- the improper use of a pesticide (i.e. off label uses)
- possible contravention of Approval conditions:
- various incidents that relate to pesticide applicator certification

Types of Investigations

AEP has broken down the types of investigations into the following categories:

- **Aerial Drift** - complaints involving aerial applicators
- **Container Sites** - incidences involving offsite movement
- **Disposal Practices** - illegal dumping of chemicals causing damage to the environment
- **Environmental Damage** - damage to public land (ie. water and land)
- **Fire**- involves the health/safety and cleanup of storage facilities that have burned down
- **Ground Drift** - involves drift onto neighbouring properties from a ground application
- **Health & Safety** - health concerns expressed by the public from an application
- **Misapplications** - application to the wrong property.
- **Offsite Movement** - movement of chemical offsite either by runoff or slope - residual herbicid
- **Unregistered Use** - product use deviates from product label instructions
- **Spill** - involves health/safety and cleanup of a spill site
- **Uncertified Applicators/Non-Registered Services**
- **Vendor**- any investigation involving a pesticide sales outlet
- **Water Buffer Violation** - noncompliance to Special Use Approval or the*Code of Practice for Pesticides* (Pesticide Applications within 30 metres of water).
- **Miscellaneous Nature** -includes investigations that are not related to pesticide damage.

Evidence

During an investigation, information is gathered to determine if a contravention has occurred and to assi in determining the appropriate enforcement response. The specific information gathered is:

- the degree of adverse or potential adverse effect on the environment or human health
- the compliance history of the party under investigation
- the intent of the party
- the extent of noncompliance
- steps taken by the party to rectify the situation

- steps taken to avoid the incident and prevent its recurrence, and
- the degree of care associated with the operation.

Additional information that may be collected:

- Witness Statements
- Applicator Statement (may include Warned Statements)
- Applicator or Sales Records
- Weather Reports
- Photographs
- Samples (vegetation, soil, water)

Penalties

The following are a list of enforcement options that may be considered in the case of contraventions to t *Alberta Environmental Protection and Enhancement Act*:

Ticketable offenses - issued for specified offenses by special constables where a previous warning o the contravention has been given and the company has failed to correct the situation. Fines range for these offenses from 100-300 dollars.

Administrative Penalties- issued by the Director for contraventions to most sections of the pesticide regulations. including administrative deficiencies. An example of a contravention in which an administrative penalty could be issued is where a summary is not submitted for a Special Use Approval. Administrative Penalties came into effect in 1995 with fine maximums up to 5000 dollars

The Director may increase or decrease the amount of the base penalty after considering the following factors:

- importance of compliance to regulatory scheme;
- the degree of wilfulness or negligence in the contravention;
- whether or not there was any mitigation of the consequences of the contravention;
- whether or not the person who receives the Administrative Penalty has a history of non-compliance;
- whether or not the person who receives the Administrative Penalty has derived any econom benefit from the contravention
- any other factors that, in the opinion of the Director, are relevant.

Environmental Protection Order - in the opinion of the Director that the manufacturer use, handlin transportation, storage sale, disposal or application of a pesticide has caused an adverse effect the Director may issue and Environmental Protection Order to the person responsible for the pesticide.

An Environmental Protection Order may order the person to whom it is directed to do any or all of th following:

- to stop, limit or control the manufacture, application or release of the pesticide into the environment permanently, or for a specified period of time in the circumstances set out in t Environmental Protection Order.
- to comply with any directions of the Director relating to the pesticide or any thing in which the pesticide is or was contained may be used, handled, transported, stored, sold, manufactured or disposed of;
- to comply with any directions of the Director with regards to the clean-up of the pesticide o the clean-up or restoration of a site affected by the pesticide.

Emergency Environmental Protection Order- Where an inspector, an investigator, or the Director of the opinion that significant adverse effect may occur, is occurring has occurred as a result of the manufacture, use handling, transportation, storage, sale disposal, or application of a pesticide, the inspector, investigator or Director may issue an Emergency Environmental Protection Order to the person responsible for the pesticide directing the performance of emergency measures that the inspector, investigator or Director considered necessary.

Offences and Penalties of AEPEA

Where an offense is committed under the Act, under the Regulations, in a case of an individual, to a fine not more that 50,000 dollars or imprisonment for a periods of not more than 2 years, or to both a fine an imprisonment, or in case of a corporation, to a fine of not more than $1,000,000.

Due diligence defence - no person shall be convicted of an offence if that person took all reasonable ste to prevent its commission.

K. HERBICIDE APPLICATIONS ON PRIVATE LAND (WOODLOTS)

Increasing numbers of farmers are considering the management of trees on privately owned land for sale wood or fibre processing facilities. Currently, most private woodlots involve the management of natural woodlands areas that may be used for grazing and recreational purposes in addition to wood and fibre production.

The Pest Management Regulatory Agency (PMRA) regulates the use patterns for pesticides and identifi two use locations pertinent to pesticide use on woodlots: forest (sites greater than 500 hectares) and woodland(s) (site less than 500 hectares). Any pesticides (herbicides, insecticides, fungicides, etc.) used for the establishment or protection of trees should be approved for either Forest or Woodland use.

The PMRA also identifies use locations pertaining to pasture and rangelands for grazing purposes, and f non-crop areas of agricultural land that would be appropriate for additional vegetation management requirements (e.g. trail maintenance). Products approved for these uses would be appropriate where a woodlot is being used for grazing or recreational purposes. Many herbicide products would be available for these uses in addition to the herbicides approved for Woodland use (the*Crop Protection With Chemicals* published by Alberta Agriculture Food & Rural Development would provide specific produc lists)

Qualifications

Commercial agriculturalists (farmers, ranchers, greenhouse operators, etc.) can purchase and use pestici (in accordance with label provisions) on their own land without obtaining pesticide applicator certificate or approvals. Anyone applying pesticides for hire/reward on privately-owned land must be approved as pesticide service. Therefore, private woodlot owners would not require any approvals provided they are performing applications on their own private property.

For applications to public land (land owned by the Government) for forest or woodland management in either the Green Area (forested land) or the White Area (non-forested Crown land), the company having control over that land must have a service registration and applications must be performed by a certified applicator holding valid Forestry class certificates **unless** pesticide applications are contracted through a registered pesticide service. For pesticide applications conducted on Crown land in the province's Green Area, all proposed pesticide applications must first be approved by the Land and Forest Service of Albe Environmental Protection before any pesticide applications can commence.

L. OPERATIONAL HERBICIDE MONITORING PROGRAM MANUAL

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Operational Herbicide Monitoring Program

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Appendix I: Plot Assessments
Appendix II: Tally Sheets

1.0 INTRODUCTION

1.1 Background

Until 1994, forest herbicide use in Alberta was generally limited to small trials. This approach allowed forest managers and the public the opportunity to gain more experience and knowledge in the use of herbicides in forest management.

Forest industry and Land and Forest Service (LFS) staff, however, believed operational use of herbicide was required on some sites to meet legislated reforestation requirements and sustained yield objectives t be met. In 1994, the Minister of Environmental Protection approved new provincial guidelines that allow limited operational use. One of the conditions for use is that the proponent implements a herbicide monitoring program.

A committee of forest industry and government representatives developed a monitor program methodol that incorporates many existing LFS sampling procedures. The methodology requires monitoring plots t be established on both treated and untreated areas. This approach will provide an opportunity for measuring the successional changes in plant species composition and coniferous seedling growth respon due to herbicide applications.

The monitoring process, while conducted in a scientific manner, is not as rigorous a methodology as a research project would require. It is instead a practical approach to gathering information on the effectiveness of herbicide use in achieving certain silvicultural objectives. This information will be usef in determining how forested lands in Alberta should be managed in future.

1.2 Purpose

The purpose of the Operational Herbicide Monitor Program is to provide information on the effects of operational silvicultural herbicide programs in Alberta.

The main objectives are as follows:

1. to quantify the effects of herbicide use on competing vegetation and on crop tree survival and growth.
2. to monitor the effects of herbicide use on plant species composition and abundance over time.

2.0 MONITOR SITE SELECTION

Site selection, plot location, establishment and reading must be completed prior to herbicide treatment.

2.1 Ecosite Matrix

At the provincial level, monitoring sites should be identified to ensure data is collected at the ecosite (moisture/nutrient regime) and reforestation practise level. To minimize duplication, proponents should consider monitoring different ecosites (if possible) from year to year.

Ecosite will be defined in terms of site characteristics identified in the Field Guides to the Ecosites of Alberta, 1996. Initially, monitoring efforts will focus on frequently treated ecosites. Efforts should be made to assess a range of reforestation practices and herbicide prescriptions across these sites.

Reforestation practise will be defined by broad treatment class rather than by specific means; for examp raised planting site will be a component of practise rather than specific types of mounder. Large planting stock, rather than a specific container size or container/transplant regime, is another example.

2.2 Monitor Plot Intensity

Sampling intensity will be determined by frequency and scale of herbicide use. Sampling intensity will revised as experience with both herbicides and monitoring increase; and as the monitoring plot location matrix is filled.

Each company that conducts an operational herbicide program greater than 100 ha must establish at leas monitor plot.

2.3 Field Site Selection

Within the candidate blocks, a minimum of 2, 2.5 hectare units with similar site characteristics (i.e. variability in site characteristics within the two units should be similar) should be identified. The units should be within the same ecosite.

One unit will be treated as part of the operational herbicide program (treatment), the other unit will be le as an untreated, "control" plot. The division between the two units must be clearly visible and the integr of each treatment must be ensured. For aerial herbicide programs, larger areas may have to be identified enable appropriate treatment/control units.

Site characteristics should be as uniform as possible across the treatment/control units. The following factors should be considered when determining site suitability.

Topographic factors:

- slope - level or uniform (+/- 10%)
- aspect - uniform (within 45°)
- position - crest, mid-slope, lower slope, toe or plain

Macro-drainage: avoid areas with ponding, stream channels

Soil moisture regime: same class (xeric, subxeric, etc.)

Soil textures: same broad class: fragmental, sandy skeletal, loamy skeletal, clayey skeletal, sandy, clayey or coarse frag. loamy content.

Elevation: variation less than 50 m

Pre-Harvest Timber type: same dominant species

3.0 CROP TREE PLOT

3.1 Location

Five, 0.01 ha crop tree plots must be located in each unit. Plots will be located along a transect using the following procedure (figure 2):

1) Using a 1:15,000 scale map (or larger) of each sample area, clearly mark and number potential cro tree transect lines. Potential lines should be orientated along the long axis of the sample unit with a minimum of spacing of 20 m (and 30 m from sample area edge).

2) Randomly select one transect line. A second line may be required if the cutblock is small. Plots should be evenly spaced slong the transect(s) with a minimum spacing of 20 m (horizontal between p centers).

3) Establish an easily identifiable tie point for each transect(s). The stake at the tie point should clear identify the disposition holder, installation number, transect type (crop-CP or vegetation-VP) and treatment type (treatment-T or control-C). Eg. Company X-01-CP-T.

4) Establish 5.64 m radius plots along the transect. Select the 12 best crop trees in each plot. The surveyor should strive to select crop trees that are well distributed throughout the plot. Spacing dista between the crop trees must be at least 1.5 meters apart. If 12 trees are not found in every plot, additional plots must be established along the transect until a total of 60 crop trees are selected.

3.2 Establishment Procedure

Use the plot locations derived in the site selection process. Drive a brightly colored post well below the frost zone (to prevent frost heaving) at crop tree plot centre. Establish plot size by using a rope and flagging to clearly mark plot radius (5.64 m) in cardinal directions.

The plot centre stake should be clearly labelled as to:
Sub-unit (treated/untreated)
Plot number

Crop trees must be permanently marked in the plot.

Figure 2 - Crop Tree Plot Location

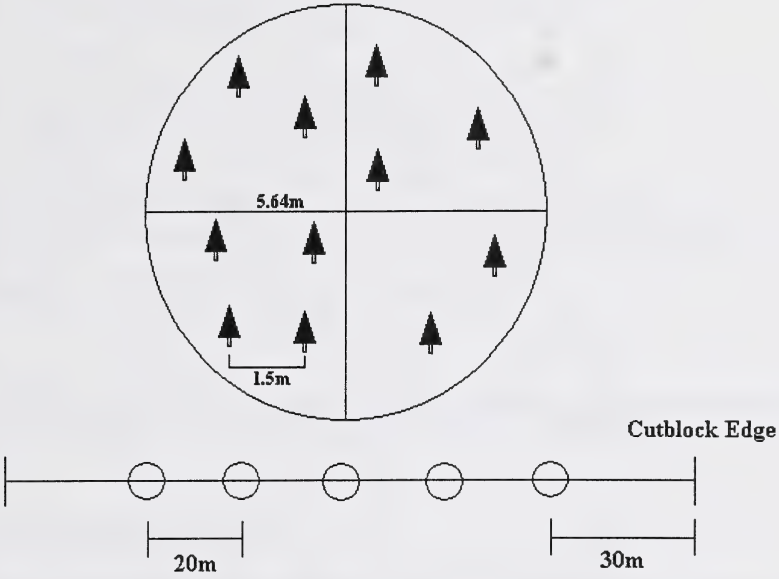
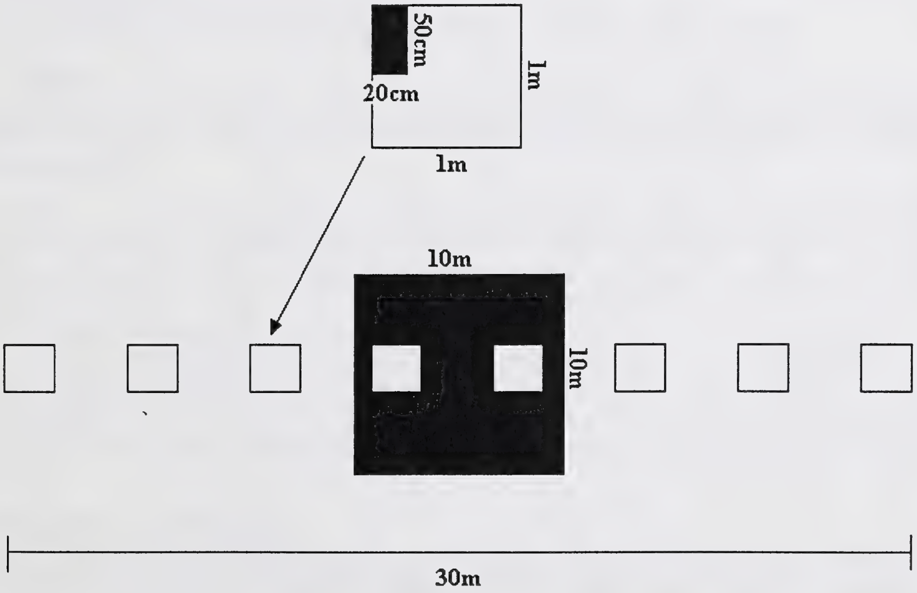


Figure 3 - Vegetation Transect Location



3.3 Plot Measurement

Once identified measurement trees should be assessed as follows:

Assessments

Tree parameter ________________ Initial _____ Subsequent _____
Species ________________ Yes _____ No _____
Probable origin ________________ Yes _____ No _____
Age ________________ Yes _____ No _____
Total height (cm) ________________ Yes _____ Yes _____
Leader length (0.5 cm) ________________ Yes _____ Yes _____
Basal diameter (1 mm) ________________ Yes _____ Yes _____
Competition type code ________________ Yes _____ No _____
Competition height code (relative height) ________________ Yes _____ Yes _____
Seedling condition code (see Appendix I) ________________ Yes _____ Yes _____
Conifer Crop tree density ________________ Yes _____ No _____
Seedling vigour code ________________ Yes _____ Yes _____
Larger vegetation density ________________ Yes _____ No _____

3.4 Assessment Techniques

Crop tree parameters identified above should be assessed as per Appendix 1. Remeasurements should be taken at the same time of year as the previous measurements to reduce variability.

4.0 VEGETATION TRANSECT LOCATION

The purpose of collecting vegetation data is to determine if there is a difference in plant species composition between treated and untreated cutblocks and to examine the successional changes between two treatments. The specific objectives include:

1. Compare species composition changes between cutblocks treated with herbicides and cutblock left untreated and
2. To examine the successional changes of the two treatments over time.

4.1 Location

Locating the vegetation transect can be delayed until the crop tree response plots are established to ensure the transect represents the average vegetation characteristics of the sub-unit (and of the overal monitoring unit).

Vegetation transects must be placed in a representative part of the monitor site. The vegetation chang monitoring transect will parallel the crop tree transect. However, transects located on slopes must be established parallel to slope contours. The vegetation and crop tree transects must be a minimum of 2 m apart to minimize damage to the vegetation. A transect must be 30 meters long with 15 microplots placed along the transect. At each location a 1 x 1 m microplot will be used to record the canopy cov of shrubs (<2.5 m in height) and a nested 20 x 50 cm microplot will be used to assess the canopy cov of forbs and graminoids. One 10 x 10 m macroplot located at the center of the 30 m transect will be used to estimate the canopy cover of trees and tall shrubs (> 2.5 m in height). Trees and tall shrubs w only have to be recorded once in the average % cover column to the nearest 5%. See Figure 3 on Pag 140.

4.2 Establishment Procedure

Drive a brightly colored 1 m metal post well below the frost zone at the centre of each microplot plac along the transect. The post should be labelled with sub unit (treated/untreated) and plot number.

4.3 Plot Measurement

Cover estimates for all other species will be recorded to the nearest 5%; those between 0 and 5%, to nearest 1%. Canopy cover estimates will be recorded at each microplot on the Herbicide Vegetation Assessment form. The plant species (trees, shrubs, graminoids and forbs) will be recorded using a

seven letter code composed of the first four letters of the genus and the first three letters of the specie (per Moss, E. H. 1983 Flora of Alberta.). If the species is unknown it will be marked on the plot shee collected and later identified. If possible all plants should have a species name. The species will be listed on the plot sheet in the following order: graminoids, forbs, shrubs and trees.

4.4 Data Entry

The mean canopy cover of each species over the 15 microplots (treated, untreated) will be entered on Excel or Lotus in the format outlined below. These files must be forwarded to the Land and Forest Service annually as required.

Spacing for Lotus or Excel file columns are: plot no=7 spaces, layer=2 spaces, species=8 spaces cover=5 spaces, species=8 spaces, cover=5 spaces, species=8 spaces, cover=5 spaces, species=8 spaces, cover=5 spaces,

(7)	(2)	(8)	(5)	(8)	(5)	(8)	(5)	(8)	(5)
Plot no.	layer	Species	Cover	Species	Cover	Species	Cover	Species	Cover
lr96tr	7	festrub	25.2	phlepra	26.3	poa pra	25.2	festsca	52.3
lr96tr	7	dantpar	0.3						
lr96tr	6	astelae	25.6	taraoff	25.2	trifrep	1.2	galibor	5.2
lr96tr	6	geumtri	0.3	antelan	2.5	astecil	2.1	trifpra	2.3
lr96tr	6	haledef	0.1						
lr96tr	5	rosaaci	2.0						
lr96un	7	phlepra	3.0	poa pra	0.3				
lr96un	6	galibor	2.0	trifpra	25.0	taraoff	35.1	haledef	12.5

Where layer is:

1=trees
2=understory trees
3=epiphytes (tree lichens)
4=tall shrubs (alder willow)
5=understory shrubs (rose, raspberry)
6=forbs
7=grasses, graminoids
8=mosses
9=lichens

Note: do not exceed a total of 4 (species, cover combinations) per row (for example if you have 5 grass species enter 4 then start a new row for the fifth), start a new row for each layer (make sure plot numbers are the same for the various layers).

4.5 Data Analysis

Classification

The data for each site will be analyzed using the multivariate analysis techniques of classification and ordination. Classification is the assignment of samples to classes or groups based on the similarity of species. A polythetic agglomerative approach will be used to group the samples. Thi technique assigns each sample to a cluster which has a single measure. It then agglomerates these clusters into a hierarchy of larger and larger clusters until finally a single cluster contains all the samples (Gauch 1982). Cluster analysis will be performed in SAS and euclidean distance will be used as the Cluster Distance Measure and Wards's method will be used in the Group Linkage Method. The groupings generated in cluster analysis with be overlain on the site ordination to determine final groupings.

Ordination

Ordination will be used to find relationships among species, communities and environmental

variables. Ordination reduces the dimensionality of the data to 1-3 most important axes to which envionrmental gradients can be assigned. The ordination technique used in the analysis of the herbicide data will be DECORANA (Detrended Correspondence Analysis). Decorana detrends an rescales the axes thereby reducing the arching and compression of axes problems associated with other ordination techniques (Reciprocal averaging, Principle Components Analysis). Once final groupings are determined on the ordination specific environmental variables can be assigned to th variation outlined on the ordination axes. For the herbicide data there likely will be a strong difference between treated and untreated transects along the first axes.

Measures of Species Diversity

It is recommended that an index of species diversity be used to determine if there is a difference between the plant species diversity of the two treatments over time. Peet (1974) provides a good review of the various species diversity indices available. These indices can basically be split into categories 1. Species richness 2. Species evenness and 3. Heterogeneity indices.

Species richness is an indicator of the relative wealth of species in a community (Peet 1974). The problem with measures of species richness is that they are dependent on sample sizes. The larger sample size the greater the expected number of species.

Species evenness refers to the relative abundance of individuals over the species list. A communi with uniform abunance of the species would have higher diversity. It is necessary to know the number of species in the underlying sample universe or community in order to use species evenne indices. This is often impossible to determine for most ecological applications (Peet 1974).

Heterogeneity indices combine both the evenness and richness components. There are two distinc types of heterogeneity indices. Type I indices are those that are most sensitive to changes in the rarest species and type II indices are those that are most sensitive to changes in the importance of most abundant species (Peet 1974). Peet also recommends that heterogeneity indices be used whe the underlying species-abundance relation and the number of species in the universe are unknown

For this study it is recommended that a combination of species richness (total number of species) mean number of species/plot, and type I and II heterogeneity indices, be used to assess the plant species diversity across the various treatments over time. A combination of a number of these indices will allow one to determind the underlying species structure of the various treatments. Fo example if the untreated sites had a high species number and a high value for a type I index (rare species) with a dramatic decline in value of the type II index (common species) compared to the treated plots, would indicate a number of plant species are being affected by the herbicide treatme An example of type I and II heterogeneity indices would be Hill's N1 and N2 indices.

5.0 MONITOR PROCEDURE

5.1 Timing and Frequency of Monitoring

Year	Crop Tree Assessment	Vegetation Change Assessment
0	Yes	Yes
1	Yes	Yes
2	No	Yes
3	Yes	Yes
4	No	Yes
5	Yes	Yes
10	Yes*	Maybe**

* Proponents may incorporate their own growth and yield program into this measurement.

** If there is no change in the vegetation between year 4 and 5, year 10 vegetation change assessment is not required.

Two photos should also be taken at each plot site at the time of measurement. The photos will be taken at photo points established in the crop tree and vegetation plots. Remeasurements should be done at the same time of the year that the initial measurements were taken.

APPENDIX I
PLOT ASSESSMENTS

1.0 Tree Height (Centimetres)

Measure the height of each individual seedling, to the nearest centimetre.

Remeasurements should be done as close as possible to the date of plot establishment. Remeasurements will always **EXCLUDE** the current year's growth.

Germinants smaller than 1 cm should always be recorded as 1, not as 0.

Seedlings with leader damage should be measured from where their stem intercepts the ground (point of origin) to the highest, undamaged part of the leader. Height measurements may be taken the top of lateral branches if they appear to be exerting apical dominance. Trees with multiple leaders (e.g. bareroot spruce) should be measured from ground level to the tip of the highest leade or node. Deciduous species with multiple stems should be measured in a similar fashion (e.g. stum suckers).

2.0 Tree Caliper (in Millimetres)

Caliper is measured approximately 2 cm above the root collar using vernier-type calipers. All tree should have root collar diameters (RCD) measured. RCD is a very good indicator of competition also provides a good comparison to a control plot.

To ensure consistentency measurements, the "2 - Finger" method should be used. Simply grasp th seedlings stem between two fingers with your palm flat on the ground. Lay the caliper "jaws" on of your fingers and close them gently around the seedling stem. Finally, remove them carefully b pulling straight (horizontally) away from the stem. Read the vernier scale to the nearest millimetr The caliper is recorded with blank fields zero-filled where necessary (e.g. 5 mm - enter 5). This is maintain consistent measurements year after year.

3.0 Competition Height and Type

This is a two digit code describing the height and type of competition affecting individual seedlin

Code	Competition Height
0	Little or no competing vegetation present.
1	Competing vegetation below seedling height.
2	Competing vegetation equal to seedling height.
3	Competing vegetation above seedling height.
4	Microsite shading (by dead or inorganic materials).
5	Crushing - seedling in close contact with organic/inorganic debris such that physical damage may occur. (Remember to replace debris to minimize the remeasurement disturbance)

The second column assesses the type of competition present:

Code	Competition Type
0	No competition
1	Herbs, forbes, etc.

2	Grasses, sedges, etc.
3	Shrubs
4	Trees

Competition should be tallied only if the canopy area of the competing vegetation overlaps approximately 40% of the seedling's canopy area. The canopy area refers to the area directly abov and below the leaves of the vegetation. If there is a number of different types of competition, the type that occupies or intercepts the greatest canopy area of the seedling should be tallied. This dominant competition type may by itself occupy less than 40% of a seedling's canopy area. The height of the competition is evaluated by distribution of competing leaf surface area relative to th height of the coniferous seedling. The two factors of height and density of competing leaves must weighed together. It was decided that height would have more weight than density of leaf surface area when overtopping occurs.

Competition will be tallied as above if the seedling is significantly overtopped by competing vegetation. Competition is to be tallied as equal to if the competition is approximately the same height as the seedling. There can be some overtopping but not a significant amount (less than 20% leaf surface area). The densest competing leaf surface area should be generally the same height as the seedling's densest leaf surface area. Competition will be tallied as below if the height of the competing vegetation is less than the seedling. There must be an insignificant amount of overtopping and the densest competing leaf surface area should be below the seedling's densest le surface area.

The third column assesses the amount of competition present:

Code	**Competition Amount**
0	None (0%)
L	Low (1-25%)
M	Medium (26-75%)
H	High (>75%)

4.0 DBH

Diameters of trees >1.3m in height will be taken. Paint a small blue dot at this location so that fut measurements are taken at the same location.

5.0 Condition Codes

Damage of Seedling. When a damaged seedling or tree (acceptable species) is encountered on site specific code is used to indicate a probable cause of injury. For the sake of simplicity these codes closely resemble the mortality codes in number and description. A damage call can be made for a individual seedling anytime a significant amount of morphological damage has been incurred. In any case, the seedling must still be alive (ie. possess some succulent plant parts or live plant material). The same call can be made again in subsequent measurements as long as the damage continues.

Whenever a damaged tree or seedling is encountered the most specific cause of damage should be noted and entered. In cases where several different types of damage affect a seedling, the most serious type should be coded (e.g. rabbit browsed tree has some frost damage - code "rabbit browsing"). Unlike coding for mortality, there is no set procedure to follow when recording seedl damage. The individual tree tally field is filled in as if the tree was healthy. A damage code representing the nature of the injury encountered is then recorded. A vigour code should then be tallied to reflect the seedling's current state of health. See condition code list which is used for regeneration and mature trees (Appendix 2).

6.0 Vigour (Seedling Vigour)

Each seedling is appraised according to it's relative vigour; based on physical characteristics at tim of measurement. A one digit code indicates the seedling's/tree's state of health as characterized by the following vigour categories:

Code		Description
0	Normal	Seedling shows average height growth in relation to other seedlings in the area. It appears normal in form, colour, and general health for the species. The seedling can show signs of minor injuries (must not significantly effect the growth performance of the seedling).
1	Suppressed	Based on physical position in relation to the vegetative cover on a subquadrat. Seedling must have a severely limited supply of light; suffer from crushing or physical smothering; or show no growth over the previous year. Used in conjunction with an "overtopped" competition code (e.g. 31, 32, 33) to indicate severe growth suppression.
2	Chlorotic	Seedling must show obvious yellowing and/or mottling of leaf colour. Used to indicate a nutrient deficiency or other "internal" disorder (i.e. must not be confused with herbicide damage).
3	Recovering	Seedling has sustained significant damage; shows signs of recovery. Physical appearance tending towards normal for species (e.g. new leader growth, wound healing progressing, etc.).
4	Regressing	Condition previously documented as damaged; shows signs of further deterioration (seedling must still be alive).

7.0 Current Seedling Seedbed (CURR S.B.)

The site condition assessment on a subquadrat basis is evaluated at each and every measurement. The purpose of this parameter is to describe the growing medium/ground cover in the general vicinity of the seedling (0.25 m^2). The code representing the dominant condition of the particular subquadrat that the seedling is located in, should be recorded. In most cases the site condition comprising the greatest percentage area will be tallied. To simplify field coding of individual subquadrats, spaces have been provided on the seedling map in which to enter each call. These codes can then be transferred to the subquadrat site condition field for individual seedlings.

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8.0 Condition Codes

Condition codes are recorded in the following priority (i.e. a tree may have 5 conditions yet there is only room to record 3, so the codes are recorded in order of priority). Record the remaining codes in the comments section on the tally sheet.

NOTE: Plots established in Mountain pine beetle areas have special codes.

Condition Code	Description
00 Healthy	No Defect.
01 Insects	Damage or mortality due to destruction of plant parts or tissue by insects. Look for evidence of eggs, eff cases, nests, chewed plant parts, etc. Similar signs on plants located off site may aid in identification of insect mortality.
02 Disease	Damage or mortality caused by disease or fungi. Cankers, discoloration, rust spotting, fungal coverings, etc. help to identify mortality under this code.
03 Rabbit Browsing	Trees killed or damaged by rabbits can be identified by clean, sharp cut marks along the branches and stems (approximately 45°angles). Chewed bark and needles also indicate rabbit damage.
04 Shepherd's Crook	Damage results in blackening and wilting of young shoots and leaves. Tips of the blackened shoots often bend back. On older leaves brownish black, irregularly shaped spots appear.
05 Browsing (other animals)	Mortality or damage due to browsing by ungulates or other animals (e.g. moose, cattle, beavers). Look for chewed tops with rough cuts or breaks.
06 Fire	Mortality or damage due to actual burning of the seedling or scorching by nearby flames.**Not to be used when seedlings are killed by sun scald**.
07 Mechanical	Trees killed or damaged by mechanical or physical means such as scarification machinery, trampling or crushing by animals, etc. Stem scars and rough breakage help to identify mortality under this code.
08 Wind Throw	Damage or mortality due to crushing by fallen or displaced logs, snags, branches, uprooted trees, etc.
09 Climate	Trees damaged or killed solely by climatic factors. These include death by freezing, sun scald, severe desiccation, ice accumulation, red belt, etc.10 Flooding
10 Flooding	Trees damaged or killed by drowning alone. Look for evidence of highwater marks on the seedling, or in the immediate area. Pull tree out of ground and check roots to

	see if the root outer coverings is falling off and is blackened.
11 Poor Planting	Damage or mortality due to improper placement of nursery stock (hand or mechanical planting). Trees may have been planted too deep, too shallow, too loosely, or at an acute angle.
12 Suppression	Trees which have been suppressed by the surrounding vegetation for a period of time long enough to damage or kill them. Mortality may be due to severe lack of light, water, nutrients (removed by the competition) or by physical smothering (i.e. heavy grasses). Reference to the previous year's damage tally may help in determining this mortality call. A tree that is over topped by grass or shrubs is not necessarily suppressed. Look for a spindly main stem with very few long needles spaced wide apart or evaluate the last five increments. If the tree has only grown 1cm a year, it is probably suppressed.
13 Frost Heaving	This code is used only when mechanical frost action can be clearly identified as the direct cause of damage or mortality. Usually upheaval and separation of the seedling's root system from the soil occurs as a result of ice lense formation. This is most commonly associated with containerized seedlings planted in silty soil.
14 Erosion	Damage or mortality due to the removal of the seedling's seedbed, by the forces of water, wind or soil slumping. Trees killed by partial or total burial (deposited soil or organic matter) would also be tallied using this code.
15 Missing	This code is to be used when a seedling from the previous year's measurement cannot be located. It can also be used where the seedling was removed from the site and probably died (i.e. tag found, no morphological signs of live seedling remaining). Using in conjunction with code 25 **ONLY**.
16 Dead top/Dieback	Top is dead (die back) without any indication of insect or climate (frost) damage.
17 Poor Seedbed	This code is to be used only when the cause of death or damage for a seedling can be traced to the type of seedbed on which it is growing. In most cases the seedling will show signs of desiccation due to the poor moisture holding capacity of the seedbed material (e.g. rotten logs, dry clay).
18 Herbicide	Should only be used when the cutblock (or parts of the cutblock) has received a recent herbicide treatment; either before or after the stock was in place. Spruce seedlings exhibit needle loss and/or reddish brown coloration of stems and foliage. Deciduous species exhibit yellowish/brown leaf mottling and dieback of terminal growth. Hexazinone causes reddish brown coloration of conifer foliage and needle loss. Deciduous foliage turns red to black. Glyphosate causes chlorosis especially in new growing shoots. 2,4-D causes rapid growth and spiralling and twisting. If applied during conifer flush bad dieback similar to frost damage may occur. Often

	chemical damage will also be indicated by phytotoxicity spotting on exposed foliage.
19 Western Gall Rust	This code is used when Lodgepole pine damage or death can be attributed to Western Gall Rust. This is usually clearly identifiable due to swelling of succulent tissue (and subsequent formation of a gall) and the bright orange spores produced in that affected area. This gall can be on the main stem or a lateral branch.
20 Armillaria Root Rot	This code is utilized when a seedling is damaged or killed by Armillaria Root Rot. Identification of the disease is in recognizing mycelial fans of the cambium of damaged and dead trees. Pull tree out of ground and examine root collar.
21 Moldy Planting Stock	This code is usually used on Bareroot Planting Stock. Grey mold will usually be found around the root collar and lower branches.
22 Multiple Leader	This damage code is commonly used on planted stock. When a tree has two or more leaders, but is otherwise healthy this code should be entered. The tree is considered multiple leadered if all leaders are within 5cms (height) of each other. This code also applies to saplings and regeneration that appear forked. Be aware of normal branching of deciduous trees.
23 Poor Form	This code is used on trees which exhibit a general poor form, due to previous damage. It is commonly used with Advanced stock which was damaged by scarification activity.
24 Broken Top (New or Old)	It should be used as long as the broken top is noticeable and has some effect on the growth of the tree.
25 Dead Tree	Tree has no signs of being alive.
26 Snow Press	This code is normally used for trees that show signs of being pressed down to the ground for a few years after germinating or being planted.
27 Dead Top Dieback with New Leader	This refers to stems that have had previous leader damage and a new leader has formed.
28 Sucker(s) (From Old Stump)	Refers to stems that have been cut-down through thinning and have started to sucker. Do not re-use the previous stem number, but assign a new number to each sucker.
29 Cutdown	Self explanatory.
30 Terminal Weevil	Terminal leaders of Pine or Spruce bend over and die. Two or more years growth are affected. Bore Holes which are exit holes for the larvae **MUST** be present to use this code.
31 Spruce Gall Aphid	Galls located at the end of new growth and may persist for many years.
32 Forest Tent Caterpillar	A tent of a silk forms on the tree and the caterpillars defoliate the tree.
33 Root Collar Weevil	This weevil feeds mainly on Sw, Pj and Pl. They feed in the bark and cambial area of the host tree at or below the duff surface, causing copious flows of resin. The tunnels often girdle small trees. This insect allows root rots to enter the tree.

34 J-Root	This code is used after the tree has had a poor planting code in the previous measurement.
35 Leaning	Tree leaning more than 20% off of vertical axis.
36 Same Stump	Used when 2 or more trees can be distinguished above ground level but below DBH. Used a lot on Deciduous that have been cutdown and resprouted at stump.
37 Unknown	This condition code is to be used only when there appears to be something affecting the tree but the other condition codes do not describe the situation. This would include burnt trees etc. A description of what is affecting the tree should be included as well in the comments column. In the event that this code is used for more than 5% of the tallies, it is up to the crew leader or a forester to decide on the cause of the condition.
38 Pitch Moth	Primary host is Lodgepole Pine. May weaken or kill the terminal leader, resulting in stem deformities and height growth reduction. Blisters are mainly on main stem and are characteristic resin coated up to 20mm in diameter.
39 DBH on New Leader	
40 Nutrient Deficiency	
51 Conk/Blind Conk	
52 Open Scars	Open scars are wounds which have been penetrated through to the cambium. These wounds must not be healed over and may be caused by a variety of reasons such as fire, lightning, old blazing, machinery, animals, etc. Scars are considered to be entry points for decay fungi. Open scars are illustrated in Figure 15. Animal damage usually penetrates the cambium therefore code as an open scar. A common mistake is to call stem disease such as atropellis canker an open scar.
53 Burls and Galls	Burls are abnormal swelling of the main stem or branches resulting from abnormal wood cell development following disturbance to the cambial layer. A burl is illustrated in Figure 16. Galls are localized trunk and branch swelling of mainly tissue. There is little or no damage to the underlying wood. Do not mistake western gall aphid for a gall, it is a foliar insect.
54 Fork	Forks usually develop when there is malformation, injury or death of the terminal leader. Forks tend to be V-shaped and will only be recorded when above 1.3 m (DBH level). Forks below this point are recorded as same stump (condition code 36). Natural branching on deciduous trees is not to be recorded. A fork must be at least 7.0 cm DIB, 2.5 m past the fork to be considered. Figure 17 demonstrates the difference between forks and natural branching.
55 Pronounced Crook	This condition develops from the death of the terminal leader or the breaking off of a forked leader. When this occurs, a lateral branch takes over apical dominance as shown in Figure 18. A crook is recorded when the inside bark diameter is at least 7.0 cm, 2.5 m above the defect.

56 Broken Top	Broken tops are recorded when the tree bole isless than 10 cm DIB (diameter inside bark) at the break.**No Crown Class**.
57 Limby	A tree is recorded as limby if more than 75% of the tree has live, low sweeping branches. In general, if the majority of the trees in a plot are limby then this code is not recorded.
58 Leaning	A tree is considered leaning if it is standing greater than 20 ° off of vertical (see Figure 19). If the angle is greater than 45° to the ground, the tree has a severe lean.**No crown class if severe**.
59 Broken Stem	A broken stem is recorded if the tree bole isgreater than 10 cm DIB at the break.**No crown class**.
60 Standing Dead	A standing dead tree is one that is dead but still standing. No green foliage or buds present. The tree must be able to withstand a firm push. Record a diameter and species but do not record height. Pound nail into tree.**No crown class**.
61 Dead or Down	A dead and down tree is one that was previously tagged and measured in a PSP plot but at the present time is now dead and no longer standing. The cause of death must be by natural causes (i.e. windfall, beavers, insect or disease, etc.).**No crown class**.
62 Stem Insects	This code is recorded when there is evidence of an insect infestation attacking the bole of the tree. Bark beetles are the most prevalent stem insects but sawyer beetles and others are included. Bark beetles,Dendroctonus spp., are a very serious problem in Alberta. The adult female enters the bark in early summer and lays eggs in the tree's cambium. The eggs overwinter and hatch as larvae in the early spring. Damage to the tree is done by the larvae eating the cambium and usually results in death. The tree will not turn red until the next summer. Other symptoms of attack are piles of "sawdust" (frass) at the base of the tree, entry holes in the bark, and pitch tubes (the tree tries to push the beetles out with resin). The beetles also carry a blue stain that causes further deterioration of wood quality. Beetles attack all species of pines, spruce, and Douglas fir. Sawyer beetle infestations are common in burned timber.
63 Stem Disease	All diseases that infect the main stem are documented with this code. Included in this code are cankers, rusts, rotten branches and root rot.Stem cankers are caused by fungi that invade stems and branches resulting in localized areas of infection in the bark and underlying wood tissue. Cankers may be annual or perennial. In perennial cankers the infected area may be eventually exposed to the underlying wood when the deadbark sloughs off. A common stem canker on lodgepole pine isAtropellis piniphila (Figure 20). Exudation of resin from the bark surface is the first external symptom. They are sunken elongated on one side of the trunk and indicate resin flow. This can cause a distortion in growth and a blue-black stain on the wood.Stem rusts are also included in this

	condition code. Rusts are host specific parasitic fungi usually requiring two alternating living hosts. Stems and branches may be girdled resulting in large malformations or even death. In particular,Endrocronartium harknessii on young pines is a serious problem in Alberta. Spruce broom rust,Chrysomyxa arctostaphi (see Figure 21), can also be noted but only if the broom is no longer green (i.e. red or missing needles). Large rotten branches typically appear on overmature, decadent trees and can be indicative of decay. Large rotten branches are those well below the base of the live Crown and are > 5 cm in diameter, are unweathered, appear punky, and are weeping (see Figure 22). Often a black ring appears on the stem surrounding the branch. Some of the typical symptoms of Armillaria root rot are reddish brown or yellowish foliage; mycelial fans form between the bark and wood around the base; fungal (shoestring) strands in the soil surrounding the diseased roots and honey mushrooms growing around the base of the diseased tree.
64 Foliar Insects	This condition code pertains to all insects that infest parts of the tree off the main stem. Included in this category are the tent caterpillar, spruce budworm, jack pine budworm, spruce gall aphid, etc. The forest tent caterpillar,Malacasoma disstria, causes severe defoliation in hardwood stands in Alberta resulting in a significant reduction in annual growth. The spruce budworm,Choristoneura fumiferana, infests mature white and black spruce, and balsam fir stands. This insect attacks the buds and new needles. Their feeding spreads to old needles and eventually kills the tree. The jack pine budworm,Choristoneura pinus, attacks stands of jack and lodgepole pine and is a relatively new forest pest in Alberta. This insect feeds and spreads in the same manner as the spruce budworm.
65 Foliar Disease	This code is used for all diseases that infect parts of the tree off the main stem. Needle casts and blights, and needle rusts are included in this condition code.
67 Closed Scars	Wounds that had penetrated the cambium but have now healed over are considered closed scars. A closed scar is characterized by an irregular indentation in the bole of the tree that would result in loss of volume due to poor wood quality. Before healing over, the scar provided an entry point for disease. Frost crack is not included in this code.
68 Atropellis Canker	Widespread on pine, from small to large trees. Symptoms are elongated, sunken, cankers on the stem with copious yellowish resin flow. Wood is discoloured blue/black.
69 Comandra Blister Rust	Pl and Pj are hosts. Local occurrence only. Infected stems are spindle-shaped with conspicuous swelling of the bark. Fungus is orange-yellow in early summer. Cankers are

	circular and grow laterally as quickly as longitudinally. They thus girdle the stem faster than stalactiform. It should not be confused with western gall rust which is mainly a swelling of the wood. Alternate host is Indian Paint Brush.
70 Elytroderma Needle Cast	Mostly on Pl. Current years needles turn red in fall. In severe cases only current needles remain, giving branches a "lion's tail" appearance.
71 Hypoxylon Canker	Hosts are aspen and balsam poplar. Canker starts as a slightly sunken orange-yellowish area on stem. Eventually girdles the stem and has an orange/black appearance. A mycelial fan on the cambium is a reliable field symptom.
72 Spruce Cone Rust	Rust isonly on spruce cones. Cones become prematurely brown then orange-yellow. When spores are abundant the forest floor has an orange colour.
73 Stalactiform Blister Rust	Pl and Pj are hosts. Local occurrence. Causes slight swelling of bark. Orange-yellow in summer. Cankers are elongated and grow faster longitudinally compared to Comandra. Alternate host is Bastard Toad Flax.
74 Tomentosus Root Rot	Most important on Sw and Sb. Symptoms are excessive branch mortality, thinning of crown and openings in the stand. Disease develops slowly (over 15-20 years) so is not so obvious in regenerating stands.
75 Bruce Spanworm	Chiefly affects aspen. Damage shows mostly as holes in the leaves. Resembles forest ten caterillar but no pupal cases or egg masses on the foliage. Caterpillars are typically light-green and have one prominent and two indistinct yellowish lines along each side of the body. The head is dark-brown.
76 Spruce Cone Maggot	No external symptoms. Dissected cone shows frass-filled spiral tunnel around the central axis.
77 Spruce Cone Worm	Feeding larvae expel frass which adheres to silken webbing on cone surface.
78 Eastern Spruce Budworm	First symptoms are webbing and frass in buds or on previous year's needles. Later, webbing is spun on branch tips. By late June tree crowns appear rust brown.
79 Mountain Pine Beetle	Main host is Pl. Symptoms are standing dead trees with beetle exit boles about eye-level. Accumulations of pitch or sawdust are conspicuous around entrance holes bored into the bark of trees by adult beetles from mid-July to mid-August.
80 Spruce Beetle	Host are Sw and Se. Symptoms are standing dead trees with beetle exit holes about eye-level. Conspicuous boring dust accumulates on bark below holes until the wind blows it away.
81 Yellow-headed Spruce Sawfly	Feed on needles in the upper crown of the tree. Partly chewed needles and needle stubs impart a brownish color and ragged appearance to the foliage. No webbing present. Found on all spruce.
82 Spruce Beetle Rust	Discoloration of needles. May find dotlike sexual fruiting structures on needles. Infected needles drop prematurely.
83 Large Aspen Tortrix	Affected foliage has a clumped, irregular appearance and leaves do not move as freely in the wind as uninfested

	leaves. Larval instars feed within rolled leaves or within 2 or more leaves pulled together and secured with silken webbing.
91-96	Dwarf mistletoes are parasitic flowering plants requiring living hosts. Mistletoe is usually recognized by swellings on branches and stems or by witches brooms. Heavy infestation makes trees susceptible to secondary attack (such as bark beetles), lower wood quality and growth losses (can be from 30-60%). The major tree hosts in Alberta are: lodgepole pine, Douglas fir and larch. Figure 24 illustrates the effect resulting from mistletoe infestations and the individual flowering plant. The Hawksworth Rating System for mistletoe is used to determine the severity of mistletoe infestation on individual trees. Figure 25 outlines instructions and gives an example of the use of the 6-class mistletoe rating systems (Hawksworth 1961, 1977). If a tree has mistletoe, record only the 90 series code, do not record 33 unless there is a second distinct foliar disease.

9.0 SUGGESTED EQUIPMENT AND SUPPLIES

Accountable-individual

Clinometer
Topofil
Pocket calculator
Tallyboard (metal 8" x 12"0)
Whistle
Hard hat
Seedling calipers
Surveyors hand compass
Claw hammer
Douglas protractor
Pocket First Aid Kit
Tally Sheets
ATV/snowmobile helmet
Metal diameter tape
2 lb hammer
Engineers scale (1:15,000 scale)
Flare gun with flares and bear bangers
Age Tally Sheet
Trapper Nelson backpack
Loggers tape
Hammer holder
Handlens
Bear repellent
Cruisers Vest
Crayon holder

Expendable

Spiral nails (6.5 cm)
Geo-flagging tape (orange, blue and yellow)
Field notebook
Blue tree marking paint
Aluminum tags - plot corner and tree
Paint pens/markers
Pencils - 2H and grease
String
Tieplates
Plot posts - metal (corner, regen and sapling)
Loggers crayon
Wire pigtail pins

Accountable-Crew

Staff compass
Camera
Stretcher
Axe
Calipers (tree and seedling)
Necessary safety
Cloth tape(s) (50 m)
Chainsaw
Canthook
Photo holder
Tool box
Height pole

equipment

10.0 Tree Species Code

Only the following species will be measured:

Common Name	Scientific Name	Species Code
Fir -Abies		
Alpine fir	A. lasiocarpa	**FA**
Balsam fir	A. balsamea	**FB**
Birch -Betula		
White birch	B. papyrifera	**BW**
Douglas-Fir -Pseudotsuga		
Douglas-fir	P. menziesii	**FD**
Larch -Larix		
Alpine larch	L. lyalii	**LA**
Tamarack	L. laricina	**LT**
Western larch	L. occidentalis	**LW**
Pine -Pinus		
Limber pine	P. flexilis	**PF**
Jack pine	P. banksiana	**PJ**
Lodgepole pine	P. contorta	**PL**
Whitebark pine	P. albicaulis	**PW**
Poplar -Poplus		
Aspen (White poplar)	P. tremuloides	**AW**
Balsam poplar	P. balsamifera	**PB**
Spruce -Picea		
Black spruce	P. mariana	**SB**
Englemann spruce	P. englemannii	**SE**
White spruce	P. glauca	**SW**

11.0 Plant Species Code

Species Code	Latin Name	Common Name
Tree Layer		
ABIE BAL	A. balsamifera	Balsam Fir
ABIE LAS	A. lasiocarpa	Alpine Fir
BETU PAP	B. papyrifera	White Birch
DC	Dead conifer	
DD	Dead deciduous	
LARI OCC	L. occidentalis	Western Larch
LARI LAR	L. laricina	Larch
LARI LYA	L. lyallii	Alpine Larch
PICE MAR	P. mariana	Black spruce
PICE GLA	P. glauca	White spruce
PICE ENG	P. engelmannii	Englemann spruce
PINU CON	P. contorta	Lodgepole pine
PINU FLE	P. flexilis	Limber pine
PINU ALB	P. albicaulis	Whitebark pine
POPU BAL	P. balsamifera	Balsam Poplar
POPU TRE	P. tremuloides	Aspen

PSEU MEN	Pseudotsuga menziesii	Douglas Fir
SHRUB LAYER		
ARCT UVA	Arctostaphylos uvaursi	Bearberry, Kinnickkinnick
ALNU CRI	Alnus crispa	Green Alder
ALNU TEN	Alnus tenuifolia	River Alder
AMEL ALN	Amelanchier alnifolia	Saskatoon Berry
BERB REP	Berberis repens	Creeping Mahonia
BETU GLA	Betula glandulosa	Dwarf Birch
BETU PUM	Betula pumila v. glandulifera	Swamp Birch
BETU OCC	Betula occidentalis	Water Birch
CHIM UMP	Chimaphila umbellata	Prince’s Pine
CORN STO	Cornus stolonifera	Red Osier Dogwood
CORY COR	Corylus cornuta	Beaked Hazelnut
GAUL HIS	Gaultheria hispidula	Creeping Snowberry
JUNI COM	Juniperus communis	Ground Juniper
JUNI HOR	Juniperus horizontalis	Creeping Juniper
LEDU GRO	Ledum groenlandicum	Labrador Tea
LINN BOR	Linnaea borealis	Twinflower
LONI DIO	Lonicera dioica v. glaucescens	Twining Honeysuckle
LONI INV	Lonicera involucrata	Bracted Honeysuckle
LONI UTA	Lonicera utahensis	Red Twinberry
MENZ FER	Menziesia ferruginea	Menziesia
OPLO HOR	Oplopanax horridum	Devil’s Club
OXYC MIC	Oxycoccus microcarpus	Small Bog Cranberry
POTE FRU	Potentilla fruticosa	Shrubby Cinquefoil
POTE NOR	Potentilla norvegica	Rough Cinquefoil
PRUN PEN	Prunus pensylvanica	Pin Cherry
PRUN VIR	Prunus virginiana	Choke Cherry
PRUN SP	Prunus species	Cherry
RHOD ALB	Rhododendron albiflorum	White-flowered Rhododendron
RIBE GLA	Ribes glandulosum	Skunk Currant
RIBE HIR	Ribes hirtellum	Wild Gooseberry
RIBE HUD	Ribes hudsoniaum	Northern Black Currant
RIBE LAC	Ribes lacustre	Bristly Black Currant
RIBE OXY	Ribes oxyacanthoides	Wild Gooseberry
RIBE TRI	Ribes triste	Wild Red Currant
RIBES SP	Ribes species	
ROSA ACI	Rosa acicularis	Prickly Rose
ROSA SP	Rosa species	Rose
ROSA WOO	Rosa woodsii	Common Wild Rose
RUBU IDA	Rubus idaeus	Wild Red Raspberry
RUBU PAR	Rubus parviflorus	Thimble Berry
RUBU SP	Rubus species	Raspberry Species
SALI ATH	Salix athabascensis	Willow
SALI BAR	Salix barklayi	Barclay's Willow
SALI BEB	Salix bebbiana	Beaked Willow
SALI GLA	Salix glauca	Smooth Willow
SALI MYR	Salix myrtillifolia	Myrtle-leaved willow
SALI PED	Salix pedicellaris	Bog Willow
SALI PET	Salix petiolaris	Basket Willow
SALI PYR	Salix pyrifolia	Balsam Willow
SALI SCO	Salix scouleriana	Willow
SALI SP	Salix species	Willow

SAMB RAC	Sambucus Racemosa	Red Elderberry
SHEP CAN	Shepherdia canadensis	Canadian Buffaloberry
SORB SCO	Sorbus scopulina	Mountain Ash
SPIR BET	Spiraea betulifolia	Birch-leaved Spirea
SPIR DEN	Spiraea densiflora	Pink Meadowsweet
SPIR SP	Spiraea species	Meadowsweet
SYMP ALB	Symphoricarpos albus	Snowberry
SYMP OCC	Symphoricarpos occidentalis	Wolfberry
VACC CAE	Vaccinium caespitosum	Dwarf Bilberry
VACC MEM	Vaccinium membranaceum	Tall Bilberry
VACC MYR	Vaccinium myrtilloides	Blueberry
VACC MYT	Vaccinium myrtillus	Low Bilberry
VACC SCO	Vaccinium scoparium	Grouse-berry
VACC ULI	Vaccinium ulignosum	Bog Bilberry
VACC VIT	Vaccinium vitis-idaea v. minus	Bog Cranberry
VIBU EDU	Viburnum edule	Lowbush Cranberry
VIBU OPU	Viburnum opulus	High-bush Cranberry
GRASS LAYER		
AGRO RIP	Agropyron riparium	Steambank Wheatgrass
AGRO SMI	Agropyron smitthi	Western Wheatgrass
AGRO SUB	Agropyron subsecundum	Bearded Wheatgrass
AGRO TRA	Agropyron trachycaulum	Slender Wheatgrass
ALOP AEQ	Alopecurus aequalis	Water Foxtail
AGRO SCA	Agrostis Scabra	Hair Bentgrass
AGRO SP	Agropyron species	
AVEN FAT	Avena fatua	Wild Oat
BROM CAR	Bromus carinatus	Brome
BROM INE	Bromus inermis	Awnless Brome
BROM CIL	Bromus ciliatus	Fringed Brome
BROM VUL	Bromus vulgaris	Columbia Brome
CALA CAN	Calamagrostis canadensis	Bluejoint Marsh Reed
CALA INE	Calamagrostis inexpansa	Northern Reed Grass
CALA NEG	Calamagrostis neglecta	Narrow, Plains Reed Grass
CALA PUR	Calamagrostis purpurascens	Purple Reed Grass
CALA RUM	Calamgrostis rubescens	Pinegrass
CARE AQU	Carex aquatilis	Water Sedge
CARE BEB	Carex bebbi	Sedge
CARE BRU	Carex brunnescens	Brownish Sedge
CARE CON	Carex concinna	Beautiful Sedge
CARE DIS	Carex disperma	Two-seeded Sedge
CARE FOE	Carex foenea	Sedge
CARE GYN	Carex gynocrates	Northern Bog Sedge
CARE HOU	Carex houghtoniana	Carex
CARE LAS	Carex lasiocarpa	Hairy-fruited Sedge
CARE LEP	Carex leptales	Bristle Stalked Sedge
CARE OBT	Carex obtusata	Blunt Sedge
CARE PRA	Carex praticola	Sedge
CARE RIC	Carex richardsonii	Richardson's Sedge
CARE ROS	Carex rostrata	Beaked Sedge
CARE SP	Carex species	Carex Species
CARE UMB	Carex umbellata	Umbellate Sedge
CARE VAG	Carex vaginata	Sheathed Sedge
CINN LAT	Cinna latifolia	Drooping Wood Reed
DANT PAR	Danthonid parryi	Parry's Oatgrass

DESC CAE	Deschampsia caespitosa	Tufted Hair Grass
DIST STR	Distichlis stricta	Salt Grass
ELYM INN	Elymus innovatus	Hairy Wild Rye
ELYM SP	Elymus species	Wild Rye
ERIO POL	Eriophorum polystachion	Cotton Grass
ERIO SP	Eriophorum species	Cotton Grass
FEST OCC	Festuco occidentalis	Western Fescue
FEST PRA	Festuca pratensis	Meadow Fescue
FEST RUB	Festuca rubra	Red Fescue
FEST SAX	Festuca saximontana	Sheet Fescue
FEST SCA	Festuca scabrella	Rough Fescue
FEST SP	Festuca species	Fescue Species
GYLYC STR	Glyceria striata	Fowl Manna Grass
GRASS SP	Grass species	
HIER ALP	Hierochloe Alpina	Alpine Sweetgrass
HIER ODO	Hierochloe odorata	Common Sweetgrass
HORD JUB	Hordeum jubatum	Foxtale Barley
JUNC BAL	Juncus balticus	Wire Rush
KOEL CRI	Koeleria cristata	June Grass
LUZU PAR	Luzula parviflora	Small-flowered Woodrush
ORYZ ASP	Oryzopsis asperifolia	Mountain Rice Grass
ORYZ PUN	Oryzopsis pungens	Short-awned Rice Grass
PANI SP	Panicum species	Panic Grass
PHLE PRA	Phleum pratense	Timothy Grass
PHRA AUS	Phragmites australis	Reed
POA GLA	Poa glauca	Bluegrass
POA INT	Poa interior	Bluegrass
POA PAL	Poa palustris	Fowl Bluegrass
POA PRA	Poa pratensis	Kentucky Bluegrass
POA SP	Poa species	
SCHI PUR	Schizachne purpurascens	False Melic
TRIS SPI	Trisetum spicatum	Spike Trisetum
XERO TEN	Xerophyllum tenax	Bear Grass
HERB LAYER		
ANAP MAR	Anaphalis margaritacea	Pearly Everlasting
ACHI MIL	Achillea millefolium	Common Yarrow
ACHI SIB	Achillea sibirica	Yarrow
ACHI SP	Achillea species	Yarrow Species
ACTA RUB	Actaea rubra	Red Baneberry
AGOS GLA	Agoseris glauca	Pale False Dandelion
AGOS SP	Agoseris species	False Dandelion
ALLI CER	Allium cernum	Nodding Onion
ANEM MUL	Anemone multifida	Windflower, Cutleaf Anemone
ANTE MIC	Antennaria microphylla	Rossy Pussytoes
ANTE SP	Antennaria species	
ANTE NEG	Antennaria neglecta	
ANTE PUL	Antennaria pulcherrima	Showy Everlasting
ANTE RAC	Antennaria racemosa	Racemose Everlasting
ANTE ROS	Antennaria rosea	Rosy Everlasting
APOC AND	Apocynum androsaemifolium	Spreading Dogbane
AQUI BRE	Aquilegia brevistyla	Blue Columbine
AQUI FLA	Aquilegia flavescens	Yellow Columbine
ARAL NUD	Aralia nudicaulis	Wild Saraspariilla

ARCE AME	Arceuthobium americanum	Dwarf Mistletoe
ARNI CHA	Arnica chamissonis	Leafy Arnica
ARNI COR	Arnica cordifolia	Heart-leaved Arnica
ARNI LAT	Arnica latifolia	Mountain Arnica
ARNI LON	Arnica longifolia	Long-leaved Arnica
ARNI SP	Arnica species	Arnica
ASTR SP	Astragalus species	Milk Vetch
ARTE CAM	Artemisia campestris	Plains Wormwood
ARTE FRI	Artemisia frigida v. americanus	Pasture Sage
ASTE CIL	Aster ciliolatus	Lindley's Aster
ASTE CON	Aster conspicuous	Showy Aster
ASTE FOL	Aster folicaeus	Aster
ASTE JUN	Aster junciformis	Rush Aster
ASTE LAE	Aster laevis	Smooth Aster
ASTE SP	Aster species	Aster species
ASTR ALP	Astragalus alpinus	Alpine Milk Vetch
ASTR EUC	Astragalus eucosmus	Milk Vetch
ASTR FRI	Astragalus frigidus	American Milk Vetch
ASTR STR	Astragalus striatus	Ascending Purple Milk Vetch
BOTR VIR	Botrychium virginianum	Grape Fern
CALY BUL	Calypso bulbosa	Venus' Slipper
CAMP ROT	Campanula rotundifolia	Bluebell, Harebell
CAST MIN	Castilleja miniata	Red Indian Paintbrush
CAST PAR	Catilleja parviflora	Small Flowered Paintbrush
CAST SP	Castilleja species	Paintbrush
CERA ARV	Cerastium arvense	Field Chickweed
CERA SP	Cerastium species	Chickweed species
CHRY IOW	Chrysoplenium iowense	Golden Saxifrage
CHRY LEU	Chrysanthemum leucanthemum	Ox-eye Daisy
CICU MAC	Cicuta maculata	Water Hemlock
CIRS ARV	Cirsium arvense	Canada Thistle
CIRS HOO	Cirsium hookerianum	White Thistle
CIRS SP	Cirsium species	Thistle Species
CIRS VUL	Cirsium vulgare	Bull Thistle
CLEM OCC	Clematis occidentalis	Purple clematis
CORA MAC	Corallorhiza maculata	Spotted Coralroot
CORA TRI	Corallorhiza trifida	Pale Coralroot
CORN CAN	Corn canadensis	Bunch Berry
CORY AUR	Corydalis aurea	Yellow Corydalis
CORY SEM	Corydalis sempervirens	Pink/Pale Corydalis
CORY SP	Corydalis species	Corydalis
CREP SP	Crepis species	Hawksbeard species
CREP TEC	Crepis tectorum	Annual Hawksbeard
CYST FRA	Cystopteris fragilis	Bladder Fern
DELP GLA	Delphinium glaucum	Tall Larkspur
DISP TRA	Disporum trachyearpum	Fairy-bells
DODE RAD	Dodecatheon radicatum	Shooting Star
DRAB AUR	Draba aurea	Golden Whitlow-Grass
DRYO CRI	Dryopteris cristata	Fern
DRYO EXP	Dryopteris expansa	Spiny Woodfern
DRYO SP	Dryopteris species	Fern
DRYO SPI	Dryopteris spinulosa	Narrow Spinulose Shield Fern
ERIG GLA	Erigeron glabellus	Wild Daisy
EPIL ANG	Epilobium angustifolium	Fireweed

EQUI ARV	Equisetum arvense	Field Horsetail
EQUI PRA	Equisetum pratense	Meadow Horsetail
EQUI SCI	Equisetum scirpoides	Dwarf Scouring Rush
EQUI SP	Equisetum species	Horsetail Species
EQUI SYL	Equisetum sylvaticum	Woodland Horsetail
EQUI VAR	Equisetum variegatum	Variegated Horsetail
ERIG PER	Erigeron peregrinus v. callianthemus	Wondering Daisy
ERIG SP	Erigeron species	Fleabane
FRAG VIR	Fragaria virginiana	Wild Strawberry
GAIL ARI	Gaillardia aristata	Gaillardia
GALE TET	Galeopsis tetrahit	Hemp Nettle
GALI BOR	Galium boreale	Northern Bedstraw
GALI TRI	Galium triflorum	Sweet-Scented Bedstraw
GENT AMA	Gentianella amarella	Felwort, Northern Gentian
GENT SP	Gentianella species	Gentian species
GEOC LIV	Geocaulon lividum	Bastard Toadflax
GERA RIC	Geranium richardsonii	Richardson Geranium
GERA SP	Geranium species	Geranium
GERA VIS	Geranium viscosissimum	Sticky purple geranium
GEUM ALE	Geum aleppicum	Yellow Avens
GEUM MAC	Geum macrophyllum	Yellow Avens
GEUM RIV	Geum rivale	Purple or Water Avens
GEUM TRI	Geum triflorum	Old Man's Whiskers
GOOD REP	Goodyera repens	Rattlesnake Plantain
GYMN DRY	Gymnocarpium dryopteris	Oak Fern
HABE HYP	Habenaria hyperborea	Northern Green Orchid
HABE OBT	Habenaria obtusata	Blunt-leaved Orchid
HABE ORB	Habenaria orbiculata	Round-leaved Orchid
HABE VIR	Habenaria viridis v. bracteata	Bracted Orchid
HALE DEF	Halenia deflexa	Spurred Gentian
HEDY ALP	Hedysarum alpinum v. americanum	American Hedysarum
HEDY SP	Hedysarum species	Hedysarum
HERA LAN	Heracleum lanatum	Cow Parsnip
HIERALB	Hieracium albiflorum	White hawkweed
HIER CAN	Hieracium canadense	Canada Hawkweed
HIER SP	Hieracium species	Hawkweed species
HIER UMB	Hieracium umbellatum	Narrow-leaved Hawkweed
LATH OCH	Lathyrus ochroleucus	Cream-coloured Vetchlin
LATH VEN	Lathyrus venosus	Peavine
LILI PHI	Lilium philadelphicum	Western Wood Lily
LINU LEW	Linum lewisii	Wild Blue Flax
LIST BOR	Listera borealis	Western Twayblade
LIST COR	Listera cordata	Heart-leaved Twayblade
LYCH DRU	Lychnis drummondii	Drummond's Cocle
LYCO ANN	Lycopodium annotinum	Stiff Club-Moss
LYCO COM	Lycopodium complanatum	Ground Cedar
LYCO SP	Lycopodium species	Club-moss
LUPI ARG	Lupinus argenteus	Perennia lupine
MAIA CAN	Maianthemum canadense	Wild Lily-of-the-Valley
MELI ALB	Melilotus alba	White sweet clover
MELI OFF	Melilotus officinalis	Yellow sweet clover
MERT PAN	Mertensia paniculata	Tall Mertensia, Lungwort

MITE NUD	Mitella nuda	Bishop's Cap, Mitrewort
ORCH ROT	Orchis rotundifolia	Round-leaved Orchid
ORTH SEC	Orthilia secunda	One-Sided Wintergreen
OSMO CHI	Osmorhiza chilensis	Blunt-fruited Sweet Cicely
OSMO DEP	Osmorhiza depauporata	Sweet Cicely
OXYT CAM	Oxytropis campestris	Late Yellow Locoweed
OXYT SER	Oxytropis sericeus v. spicata	Early Yellow Locoweed
OXYT SPL	Oxytropis splendens	showy loco-weed
PARN FIM	Parnassia fimbriata	Fringed Grass-of Parnas
PARN PAL	Parnassia palustris	Northern grass-of-parnassus
PEDI BRA	Pedicularis bracteosa	Bracted lousewort
PEDI CAP	Pedicularis capitata	Few-flowered lousewort
PEDI GRO	Pedicularis groenlandicam	Elephant Head
PEDI LAB	Pedicularis labradoricam	Labrador Lousewort
PENS PRO	Penstemon procerus	Slender Blue Beardtongue
PETA PAL	Petasites palmatus	Palmate-leaved Coltsfoot
PETA SAG	Petasites sagittatus	Arrow-leaved Coltsfoot
PICR ECH	Picris echioides	Bristly ox-tongue
PLAN MAJ	Plantago major	Common plantain
POLY BIS	Polygonum bistortoides	Western Bistort
POLY CAE	Polygonum caeruleum spp. occidentale	Jacob's Ladder
POLY VIV	Polygonum viviparum	Alpine Bistort
POTE ARG	Potentilla arguta	White Cinquefoil
POTE GLA	Potentilla glandulosa spp. pseudorupestris	Cinquefoil
POTE GRA	Potentilla gracilis	Graceful Cinquefoil
PYRO ASA	Pyrola asarifolia	Common Pink Wintergreen
PYRO BRA	Pyrola bracteata	Large wintergreen
PYRO CHL	Pyrola chlorantha	Green Wintergreen
PYRO ORB		
PYRO SP	Pyrola species	Wintergreen
RANU ACR	Ranunculus acris	Tall buttercup
RHIN CRI	Rhinanthus cristagalli	Yellow Rattle
RHIN MIN	Rhinanthus minor	Yellow rattle
RUBU ARC	Rubus arcticus	Dwarf Raspberry
RUBU PED	Rubus pedatus	Five-leaved bramble
RUBU PUB	Rubus pubescens	Dewberry
RUBU SP	Rubus species	
RUME ACE	Rumex acetosa	Green sorrel
RUME OCC	Rumex occidentalis v. fenestratus	Western Dock
SAXI BRO	Saxifraga bronchialis	Prickly Saxifrage
SCIR VAL	Scirpus validus	Common great bulrush
SCUT GAL	Scutellaria galericulata	Skullcap
SEDU STE	Sedum stenopetalum	Common Stonecap
SELA DEN	Selaginella densa	Prairie Selaginella
SENE CAN	Senecio canus	Prairie Groundsel
SENE PAU	Senecio pauperculus	Balsam Groundsel
SENE PSE	Senecio pseudaureus	Stream bank butterweed
SENE SP	Senecio species	Graundsel
SENE TRI	Senecio triangularis	Arrow-leaved groundsel
SMIL RAC	Smilacina racemosa	False Solomon's Seal
SMIL STE	Smilacina stellata	Star-flowered Solomon Seal
SMIL TRI	Smilacina trifolia	Three-leaved Solomon Seal

SOLI CAN	Solidago canadensis	Canada goldenrod
SOLI GIG	Solidago gigantea	Goldenrod
SOLI MUL	Solidago multiradiata	Alpine Goldenrod
SOLI SP	Solidago species	Goldenrod species
SOLI SPA	Solidago spathulata	Spike Like Golden Rod
SONC ARV	Sonchus arvensis	Perennial sow thistle
SONC SP	Sonchus species	Sow thistle
SPIR ROM	Spiranthes romanzoffiana	Ladies' Tresses
STEL CAL	Stellaria calycantha	Northern starwort
STEL LON	Stellaria longifolia	Long-leaved Chickweed
STEL SP	Stellaria species	Starwort species
STEN OCC	Stenanthium occidentale	Bronze Bells
STRE AMP	Streptopus amplexifolius	Twisted Stalk
TANA VUL	Tanacetum vulgare	Common tansy
TARA CER	Taraxacum ceratophrum	Horned Dandelion
TARA OFF	Taraxacum officinale	Common Dandelion
TARA SP	Taraxacum species	
THAL VEN	Thalictrum venulosum	Veiny Meadow Rue
THER RHO	Thermopsis rhombifolia	Golden bean
TRIF AUR	Trifolium aureum	Hop clover
TRIF PRA	Trifolium pratense	Red Cover
TRIF REP	Trifolium repens	White Clover
TRIF SP	Trifolium species	Clover Species
THPH LAT	Typha latifolia	Cattail
URTI DIO	Urtica dioica	Common nettler
VERA ESC	Veratrum eschscholtzii	False hellebore
VERO SP	Veronica species	
VERO WOR	Veronica wormskioldii	Alpine Speedwell
VICI AME	Vicia americana	Wild Vetch
VIOL ADU	Viola adunca	Early Blue Violet
VIOL CAN	Viola canadensis	Canada Violet
VIOL REN	Viola renifolia	Kidney-leaved Violet
VIOL RUG	Viola rugulosa	Western Canada Violet
VIOL SP	Viola species	Violet
ZIZI APT	Zizia aptera	Meadow Parsnip
ZYGA ELE	Zygadenus elegans	Death Camas

MOSSES AND LIVERWORTS

AMBL SER	Amblystegium serpens	
ANAS HEL	Anastrophyllum helleranum	
AULA PAL	Aulacomnium palustre	Glow Moss
AULA SP	Aulacomnium species	
BARB HAT	Barbilophozia hatcheri	Liverwort
BRAC OED	Brachythecium Oedipum	Short-leaved Ragged Moss
BRAC SAL	Brachythecium salebrosum	
BRAC STA	Brachythecium starkei	
BRAC TUR	Brachythecium turgidum	
BRYU CAE	Bryum caespiticium	
BRYU PSE	Bryum pseudotriquetrum	
CALL GIG	Calliergon giganteum	
CALY SPH	Calypogeja sphagnicola	
CAMP CHR	Campylium chrysophyllum	
CAMP HIS	Campylium hispidulum	
CAMP STE	Campylium stellatum	
CEPH LUN	Cephalozia lunufifolia	

CERA PUR	Ceratodon purpureus	Fire Moss
CLAD BAC	Cladonia bacillaris	
CLIM DEN	Climacium dendroides	
DICR ACU	Dicranum acutifolium	
DICR CON	Dicranum condensatum	
DICR ELO	Dicranum elongatum	
DICR FLA	Dicranum flagellare	
DICR FRA	Dicranum fragilifolium	
DICR FUS	Dicranum fuscenscens	
DICR GRO	Dicranum groenlandicum	
DICR MUE	Dicranum muehlenbeckii v. cirratum	
DICR POL	Dicranum polysetum	
DICR SCO	Dicranum scoparium	
DICR SP	Dicranum species	
DICR UND	Dicranum undulatum	
DIST CAP	Distichium capillaceum	
DREP ADU	Drepanocladus aduncus	
DREP REV	Drepanocladus revolvens	
DREP UNC	Drepanocladus uncinatus	
DREP VER	Drepanocladus vernicosus	
EURH PUL	Eurhynchium pulchellum	
FUNA HYG	Funaria hygrometrica	
GEOC GRA	Geocalyz graveolans	
HEDW CIL	Hedwigia ciliata	
HYLO SP	Hylocomium species	
HYLO SPL	Hylocomium splendens	Stair Step Moss
HYPN PRA	Hypnum pratense	
HYPN REV	Hypnum revolutum	
JAME AUT	Jamesoniella autumnalis	
LEPI REP	Lepidozia reptans	
LEPT PYR	Leptobryum pyriforme	
LOPH GUT	Lophozia guttulata	
LOPH INC	Lophozia incisa	
LOPH LON	Lophozia longidens	
LOPH VEN	Lophozia ventricosa	
MNIU SP	Mnium species	
MNIU SPI	Mnium spinulosum	
MYLI ANO	Mylia anomala	
MYUR JUL	Myurella julacea	
ONCO WAH	Oncophorus wahlenbergii	
ORTH RUP	Orthotrichum rupestre	
ORTH SPE	Orthotrichum speciosum	
PLAG ASP	Plagiochila asplenoides	
PLAG CUS	Plagiomnium cuspidatum	
PLAG DRU	Plagiomnium drummondii	
PLAG MED	Plagiomnium medium	
PLEU SCH	Pleurozium schreberi	
POHL NUT	Pohlia nutans	
POLY ALP	Polytrichum Alpinum	Stiff-leaved Polytrichum
POLY COM	Polytrichum commune	
POLY JUN	Polytrichum juniperinum	
POLY SP	Polytrichum Species	
POLY STR	Polytrichum strictum	

PTIL CIL	Ptilium ciliare	
PTIL CRI	Ptilium crista-castrensis	Knight's Plume
PTIL PUL	Ptilium pulcherrimum	
PYLA POL	Pylaisiella polyantha	
RHIZ PSE	Rhizomnium pseudopunctatum	
RHYT RUG	Rhytidium rugosum	
SPHA ANG	Sphagnum angustifolium	
SPHA CAP	Sphagnum capillaceum	Common red sphagnum
SPHA FUS	Sphagnum fuscum	
SPHA SP	Sphagnum Species	
SPHA WAR	Sphagnum warnstorfii	
SPLA AMP	Splachnum ampullaccum	
SPLA SPH	Splachnum sphaericum	
TAYL SER	Tayloria serrata	
TETR ANG	Tetraplodon angustatus	
TETR MIN	Tetraplodon minoides	
TETR PEL	Tetrphis pellucida	
THUI ABI	Thuidium abietinum	
THUI REC	Thuidium recognitum	
TIMM AUS	Timmia austriaca	
TOME NIT	Tomenthypnum nitens	
TORT MUC	Tortula mucronifolia	
TORT RUR	Tortula ruralis	
TRIT EXS	Tritomaria exsecta	
LICHENS		
BACI SPH	Bacidian sphaeroides	
BRYO FRE	Bryoria fremontii	
BRYO FUS	Bryoria fuscescens	
CETR CUC	Cetraria cucullata	
CETR ERI	Cetraria ericetorum	
CETR HAL	Cetraria halei	
CETR ISL	Cetraria islandica	
CETR NIV	Cetraria nivalis	
CETR PIN	Cetraria pinastri	
CLAD BOT	Cladonia botrytes	
CLAD CAR	Cladonia carneola	
CLAD CEN	Cladonia cenotea	
CLAD CHL	Cladonia chlorophaea	
CLAD COC	Cladonia coccifera	
CLAD CON	Cladonia coniocraea	
CLAD COR	Cladonia cornuta	
CLAD DEF	Cladonia deformis	
CLAD ECM	Cladonia ecmocyna	
CLAD FIM	Cladonia fimbriata	
CLAD GRA	Cladonia gracilis	
CLAD MIT	Cladonia multiformis	
CLAD PLE	Cladonia pleurota	
CLAD PYX	Cladonia pyxidata	
CLAD RAN	Cladonia rangiferina	
CLAD SP	Cladonia Species	
EVER MES	Evernia mesomorpha	
HYPO BIT	Hypogymnia bitteri	
HYPO PHY	Hypogymnia physodes	
ICMA ERI	Icmadophila ericetorum	Spraypaint Lichen

LETH VUL	Letharia vulpina	
LOBA PUL	Lobaria pulmonaria	Lungwort
PARM ALE	Parmeliopsis aleurites	
PARM AMB	Parmeliopsis ambigua	
PARM HYP	Parmeliopsis hyperopta	
PARM SUL	Parmelia suleata	
PELT APH	Peltigera aphthosa	Green Dog Lichen
PELT CAN	Peltigera canina	
PELT MAL	Peltigera malacea	
PELT POL	Peltigera polydactyla	
PELT SP	Peltigera species	
PHYS ADS	Physicia adscendens	
PLAG SP	Plagiomnium species	Leafy moss
PLAT GLA	Platismatia glauca	
RAMA FAS	Ramalina fastigiata	
RAMA POL	Ramalina pollinaria	
STER TOM	Stereocaulon tomentosum	
USNE GLA	Usnea glabrescens	
USNE HIR	Usnea hirta	
USNE SOR	Usnea sorediifera	
USNE SUB	Usnea subfloridana	
USNE SP	Usnea species	
XANT POL	Xanthoria polycarpa	
XANT STR	Xanthoria	

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Alberta Environmental Protection

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forests

Alberta
ENVIRONMENT

APPENDIX II
TALLY SHEETS

Operational Herbicide Monitor Program

COVER SHEET

Company Name:
Management Unit and Disposition:
Block #:
SRMS Block #:
Ecosite Phase:
Treatment Sub-Unit:
Replicate:
Vegetation Management Monitoring Matrix Description:

Silvicultural History		
Harvest	Year:	Method:
Site preparation	Year:	Method:
Re-treatment?	Year:	Method:
Re-treatment?	Year:	Method:
Re-treatment?	Year:	Method:
Establishment:	Year:	Method:
Species:	Stock Type (if app):	
Re-treatment?	Year:	Method:
Species:	Stock Type (if app):	
Re-treatment?	Year:	Method:
Species:	Stock Type (if app):	

Chemical Data
Chemical Name and Form:
Application Rate:
Application Method:
Application Date:

Weather Data

Temperature:
Precipitation:
Wind (direction & speed):

Herbicide Crop Tree Assessment Sheet

Click here for a printable copy of this form

Company Name:	**Date:**
Licence:	**Block #:**
Installation #:	**Surveyed By:**
Matrix Description:	

Plot #	Crop Tree Density	SW		PJ		PL		LT		FB	
	Vegetation Density	AW		PB		AL		SX		BW	

	Crop Tree											**Competition**		
Tree #	Quadrant	Species	Origin (seed / plant)	Tree Age	Total	Inc	RCD mm	Vigour	**Condition Code**			**Competition Code**		
									CC1	CC2	CC3	Type	Hgt	Amt
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														

Remarks:
Tie Points:

Assessment Codes

Competition Height		**Competition Type**		**Competition Amount**		**Crop Tree Vigour**	
0	Little or none	0	None	O	0-10%	0	Normal
1	Below seedling	1	Herb, forbs	L	11-35%	1	Suppressed
2	Equal to	2	Grasses, sedges	M	36-70%	2	Chlorotic

3	Above seedling	3	Shrubs	H	71-100%	3	Recovering
4	Microshade (by dead or inorganics)	4	Trees			4	Regressing
5	Crushing						

Herbicide Vegetation Assessment

Click here for a printable copy of this form

Company Name:	**Date:**
Licence:	**Block #:**
Installation #:	**Surveyed By:**
Matrix Description:	

Tag #	**Microplots**															**Macroplots**		
																Tag #		
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Species**		**%**

Remarks:

Tie Points:

Herbicide Excursion Reporting Form

Click here for a printable copy of this form

Company Name:
Company Address:
Contact Name:
Contact Telephone No.:

Name of Pesticide
Application Service:

REPORTED INCIDENT INFORMATION:

Incident Date:(dd/mm/yy)		**Incident Time:**	
Location of Incident:			
Licence / FMA No.:			
Cutblock No.:			
Number of excursions:			

	M	RGE	TWP	SEC	1/4
Legal Land Description:					

Comments:	

INCIDENT TYPE:	INCIDENT SUB-TYPE:*(check one)*					
IMP - IMPACT		Property Damage				
LEG - LEGISLATION		OPR - Operating without approval / authorization		REG - Regulation (No Impact)		NRU - Non-Registered Use
		APP - Approval Condition (Applying pesticides contrary to SUA)		TRN - No Training Certificate		
REL - RELEASE		SPL - Spill		DSC – Discharge		

Pesticide:	
Type and Extent of Damage	
Vegetation:	
Non Vegetation:	
Suspected cause:	
Follow up action taken (if any):	

Comments:	

Date Closed:(dd/mm/yy)		**A.E.P. Region:**	

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